

Music \TeX

Using \TeX to write polyphonic or instrumental music

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1 What is Music \TeX ?

Music \TeX is a set of \TeX macros to typeset polyphonic, orchestral or polyphonic music.

Two *sizes* are available : 16pt and 20pt (standard) staff heights. For that purpose, it uses special *fonts* : `musicn16`, `slurn16`, `beamn16` and `musicn20`, `slurn20`, `beamn20` respectively.

It is to be emphasized that Music \TeX is not intended to be a compiler which would translate into \TeX some standard musical notations, nor to decide by itself about aesthetic problems in music typing. Music \TeX only typesets staves, notes, chords, beams, slurs and ornaments as requested by the composer. Since it makes very few typesetting decisions, Music \TeX appears to be a versatile and rather powerful tool. However, due to the important amount of informations to be provided to the typesetting process, coding Music \TeX might appear to be awfully complicated, just as the real keyboard or orchestral music. It should be interfaced therefore by some pre-compiler in the case of the composer/typesetter wanting aesthetic decisions to be automatically made by somebody (or something) else.

1.1 Music typesetting is two-dimensional

Most of the people who just learnt a bit of music at college probably think that music is a linear sequence of symbols, just as literary texts to be \TeX -ed. In fact, with the exception of strictly monodic instruments like most orchestral wind instruments, one should be aware that reading music actually is a matricial operation : the musician successively reads *columns* of simultaneous notes. This is the reason why, in Music \TeX the fundamental *macro* is of the form

```
\notes ... & ... & ... \enotes
```

where the character `&` is used to separate the notes to be typeset on respective staves of the various instruments, starting from the bottom.

In the case of an instrument whose score has to be written with several staves, these staves are separated by the character `|`. Thus, a score written for a keyboard instrument and a monodic instrument (for example piano and violin) will be coded as follows :

```
\notes ... | ... & ... \enotes
```

for each column of simultaneous notes.

1.2 The spacing of the notes

It seems that many books have dealt with this problem. Although it can lead to interesting algorithms, we think it is a rather minor one.

In fact, each column of notes has not necessarily the same spacing and, in principle, this *spacing* should depend on the shortest duration of the simultaneous notes. But this cannot be established as a rule, for at least two reasons :

1. spacing does not depend only of the local notes, but also on the context, at least in the same bar.
2. in the case of polyphonic music, exceptions can easily be found. Here is an example :



where it can be clearly seen that the half notes at beats 2 and 3 must be spaced as if they were quarter notes, since they overlap, which is obvious only because of the presence of the indication of the *meter* 4/4.

Therefore, we preferred to provide the composer/typesetter with a set of macros, the spacing of which increases by a factor of $\sqrt{2}$ (incidentally, this can be adjusted) :

```

\notes ... & ... & ... \enotes % 1 spatial unit
\Notes ... & ... & ... \enotes % 1.4 spacial unit
\NOTes ... & ... & ... \enotes % 2 spatial units
\NOTEs ... & ... & ... \enotes % 2.8 spatial units
\NOTES ... & ... & ... \enotes % 4 spatial units
\NOTES ... & ... & ... \enotes % 5.6 spatial units

```

The size of the spatial unit (`\elemskip`) can be freely adjusted. In addition, MusicTEX provides a means of adjusting the note spacing according to an average number of elementary spaces within a line (macro `\autolines`).

1.3 Music tokens, rather than a readymade generator

The tokens provided by MusicTEX are :

- the note symbols *without stem* ;
- the note symbols *with stems, and hooks for eighth notes and beyond* ;
- the indications of beam beginnings and beam ends ;
- the indications of beginnings and ends of ties and slurs ;
- the indications of accidentals ;
- the ornaments : arpeggios, trills, mordents, pincés, turns, staccatos and pizzicatos, fermatas ;
- the bars, the meter and signature changes, etc.

Thus, `\wh g` produces an *A* (445 Hz) whose duration is a *whole note*. In the same way, `\qu c` produces a *C* (250 Hz approx.) whose value is a *quarter note with stem up*, `\cl J` produces a *C* (125 Hz approx.) whose duration is an *eighth note with stem down*, etc.

To generate quarter, eighth, sixteenth, etc. chords, the macro `\zq` can be used : it produces a quarter note head whose position is memorized and recalled when another stemmed note (possibly with a hook) is coded ;

then the stem is adjusted to link all simultaneous notes. Thus, the perfect C-major chord, i.e.

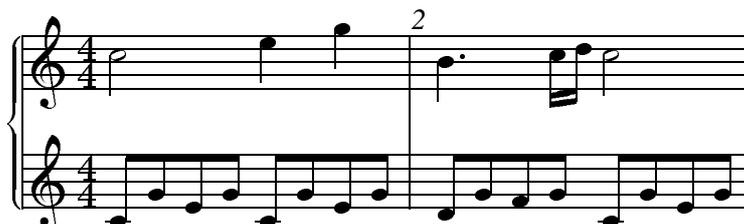


is coded `\zq c\zq e\zq g\qu j` or, in a more concise way, `\zq{ceg}\qu j` (stem up) : in fact, single notes are treated... like one-note chords.

Beams are generated using macros which define their beginning (at the current horizontal position), together with their altitude, their sense (upper of lower), their multiplicity, their slope and their reference number. This latter feature – the reference number – appears to be necessary, since one may want to write beams whose horizontal extents overlap : therefore, it is necessary to specify which beam the notes hang on and which beam is terminated at a given position.

Besides, a general macro (`\zcharnote`) provides a means of putting any sequence of symbols (in fact, some `\hbox{...}`) at any pitch of any staff of any instrument. Thus, any symbol defined in a font (letters, math symbols, etc.) can be used to typeset music.

Before entering details, we give below an example of the two first bars of the sonata in C-major by MOZART (Mozart, K545) :



The *coding* is set as follows :

```

\def\nbinstruments{1}\relax % a single instrument
\nbporteesi=2\relax % with two staves
\generalmeter{\meterfrac{4}{4}}\relax % meter is 4/4
\debutmorceau % initiates staves, clefs, indication of the meter.
\normal % normal spacing (14pt for \Notes)
\tamps\Notes\ibu0f0\qh0{cge}\tbu0\qh0g|\hl j\enotes
% \ibu0f0 begins an upper beam, aligned on the f, reference number 0, slope 0.
% \tbu0 terminates this beam before writing the second g by means of \qh0g,
% where \qh. . indicates a note hanging on a beam.
\tamps\Notes\ibu0f0\qh0{cge}\tbu0\qh0g|\ql l\sk\ql n\enotes
% \sk sets a space between the two quarters at the right hand, so that
% the second is aligned with the third eighth of the left hand.

```

```

\barre      % bar.
\Notes\ibu0f0\qh0{dgf}|\qlp i\enotes      % \qlp = quarter with a point.
\notes\tbu0\qh0g|\ibb11j3\qb1j\tb11\qb1k\enotes
      % \ibb11j3 begins a double beam, aligned on the C (j at this pitch) of slope 0.15.
\temps\Notes\ibu0f0\qh0{cge}\tbu0\qh0g|\hl j\enotes
\suspmorceau      % closing with a simple bar (for short excerpts).

```

1.4 Other highlights

Music \TeX is intended to handle up to six instruments, each of which may be typeset on zero to four staves (zero staff is used to record the text of vocal parts).

Signatures are stated either for all instruments, such as: `\generalsignature=-2` which sets two flats on each staff, but this can be partly overridden by `\signatureiii=1` which puts one sharp on the staves of *instrument number 2* (ii). Of course, signature may change at any time as well as meters and clefs.

Besides, two frequently posed questions deserve an answer. The first one is: “*can Music \TeX transpose a score ?*”. The answer is now 99.5 % yes. In fact, there is an internal register named `\transpose` the default value of which is zero, but it may be set to any positive or negative reasonable value. Then, it offsets all symbols pitched with letter symbols by that number of pitch steps. However, it will not change the signature, and if – for example – you transpose by 1 pitch a piece written in *C*, it will not know whether you want it in *D \flat* , in *D* or in *D \sharp* . This might become tricky if accidentals occur within the piece, which might have to be converted into flats, naturals, sharps or double sharps, depending on the new chosen signature. To circumvent this trouble, *relative* accidentals have been implemented, the actual output of which depends of the pitch of this accidental and of the current signature.

The second question is: “*can I write an orchestral score and extract the separate scores for individual instruments ?*” The answer is 95 % yes: in fact, you can define your own macros `\mynotes... \enotes`, `\myNotes... \enotes` with as many arguments as there are in the orchestral score (hope this is less or equal to 9, but \TeX pers know how to work around) and change its definition depending on the selected instrument (or insert a test on the value of some selection register). But the limitation is that the numbering of instruments may change, so that `\signatureiii` may have to become `\signaturei` if instrument *iii* is alone. But this is not a serious problem for average \TeX wizard apprentices.

1.5 How to get it

The whole *distribution* fits into a single 1.2Mbyte or 1.44Mbyte diskette. It can also be obtained through an *anonymous ftp* at `rsovax.ups.circe.fr`

(130.84.128.100), after selecting the subdirectory `[.musictex]`. All sources (including fonts) are provided, either separately, or “zipped” or as VMS “save sets”.

1.6 Implementation and restrictions

The macroinstruction file Music \TeX contains approximately 2500 lines of code, that is 80 000 bytes approximately. This requires your score to be compiled by the most extended versions of \TeX (65 000 words of working memory). In desperate situations, we recommend using the “Big \TeX ” processors which, unfortunately, perform a great deal of disk input/outputs (on PCs) which make them awfully slow.

In particular, the number of registers it uses makes it doubtfully compatible with La \TeX .

Ties and slurs have been implemented in a way which may look rather ugly, but we think it is the only way of implementing *in one pass* ties and slurs which run *across glue*. The principle is to have tie/slur symbols with a rather long part of horizontal stuff. Then, at each time a glue occurs and at each time a group of notes is coded while a slur or tie is pending, an `\hrule` is issued which overlaps the preceding tie/slur symbol so that the final output seems to contain a continuous line. Unfortunately, this is possible only in the glue expansion direction, namely in the horizontal direction.

1.7 Acknowledgements

The idea of implementing the present package is due to the previous work (M $\mu\TeX$) of Andrea STEINBACH and Angelika SCHOFER¹. This work provided the basis of the Metafont codes and some line breaking procedures, which both are still used here... with 99% corrections and updates.

2 Practical use

2.1 Heading statements

Before any reference to Music \TeX macros:

```

\input musicnft
\input musictex

```

which may be followed by `\input musicadd` in the case you have more than six instruments (voice is two instruments: one for the music, one for the text) or more than 6 simultaneous beams or ties or slurs.

¹ Steinbach A. & Schofer A., *Theses* (1987, 1988), Rheinische Friedrich-Wilhelms Universität, Bonn, Germany.

After that, you may write a complete book of T_EX provided that you do not use & as a tabulation character (its `\catcode` has been changed) and that you do not overwrite MusicT_EX's definitions. This means that no special macros have been designed to help you write titles, author names, comments, literature excerpts, etc.

2.2 Before you begin to write notes

You should first specify whether you want to typeset music in size 20pt par staff or 16pt. This is only optional, the default value being 20pt. If you want the 16pt size, then you have to say :

```
\musicsize=16
```

Then, the first compulsory declaration is :

```
\def\nbinstruments{n}
```

where n is the number of instruments, used by MusicT_EX to perform loops building staves, setting signatures, meters, etc. Therefore, it must be defined before any other statements. An instrument may consist of several staves, e.g. the piano. The difference between one instrument of several staves and several instruments is as follows :

- distinct instruments may have distinct *signatures*, distinct staves of a unique instrument share the same signature.
- *stems* may be hung to *beams* belonging to different staves of the same instrument.
- *chords* may extend across several staves of the same instrument.
- staves of a unique *instrument* are tied together with a big brace at the beginning of each line.

If the number of staves (in french "*portées*") is not equal to one, this number must be specified by :

```
\nbporteer=p\relax
```

where p is the number of staves, and where r is the roman numeral of the instrument considered (e.g. `\nbporteesiii` for the 3rd instrument, starting from the bottom).

If the signature is not void, one should code :

```
\generalsignature=s\relax
```

where $s > 0$ indicates the number of *sharps* in the signature and $s < 0$ the number of *flats*².

If there a *meter* indication is to be posted, it should be specified using the macro

```
\generalmeter{m}%
```

where m is the description of the meter indication which should appear on each staff. If it is a *fraction* (e.g. 3/4)

one should code

```
\generalmeter{\meterfrac{3}{4}}%
```

or, in a simpler way (if the numbers are less than 10) :

```
\generalmeter{\meterfrac 34}%
```

Special denotations can be used, such as `\allabreve` to get ♩ and `\meterC` to get ♩ .

However, not all music scores have the same meter in each staff. Especially, some staves may have *ternary* meters while others have *binary*. This can be specified by using the `\generalmeter` macro to set the meter for most of the scores and overriding it by means of a more sophisticated command :

```
\metertoksii={{\meterfrac{12}{8}}{\allabreve}}%
```

which sets the meter to 12/8 for the first (lower) staff, and *alla breve* for the second staff of the instrument number 2 (*ii*). Note that there is room for 4 staves and that void items must be specified, otherwise T_EX weird errors occur.

If you want the *name of the instruments* (or the *name of the voices*) to be displayed in front of their respective staves at the beginning, you may code :

```
\def\instrumentr{name of the instrument}%
```

where r is the roman numeral of the instrument considered. In this case, you should also adjust the `\parindent` dimension so that the long name of an instrument does not spill too far into the left margin.

2.3 Starting your masterpiece

Just code

```
\debutmorceau
```

which will initiate (with indentation `\parindent`) the first set of staves for all instruments you have previously defined. But that is not sufficient to begin writing notes and silences. In fact, you also must choose the spacing of the notes. This is done by saying

```
\normal
```

if you want an elementary spacing of 10pt. If you say `\large` the elementary spacing (`\elemskip`) is set to 12pt. Once this is done, you can select $\sqrt{2}$ multiples of this spacing by initiating your column with `\notes` (spacing `\elemskip`), `\Notes` (spacing `1.4\elemskip`), etc. If these values of `\elemskip` are not fit to your needs, you can also say

```
\normal\elemskip=15pt
```

Of course, if you are sufficiently skilled with T_EX, you can also compute `\elemskip` according to the number of bars you want in a line and the number of notes in each bar. Incidentally, this is done by the `\autolines` macro which will be introduced later.

²We have seen once a score in G-minor where the signature consisted in two flats (B and E) plus one sharp (F). This is not supported by MusicT_EX.

In practice, the choice of the macro `\notes`, `\Notes`, `\NOTes`, etc., to initiate of column of notes sets an internal dimension register, named `\noteskip` to the given multiple of `\elemskip`. The text of the macros `\normal`, `\large`³ and `\etroit` is thus rather simple :

```
\def\normal{\ifdim\Interligne<0.1pt%
  \computewidths\fi % (ignore this safety)
\elemskip=2\Interligne\relax %
  % (i.e. 10 points)
\def\notes{\vnotes 1.0\elemskip }%
\def\Notes{\vnotes 1.4\elemskip }%
\def\NOTes{\vnotes 2.0\elemskip }%
\def\NOTes{\vnotes 2.8\elemskip }%
\def\NOTes{\vnotes 4.0\elemskip }%
\def\NOTES{\vnotes 5.6\elemskip }}%

\def\large{\normal\elemskip=2.4%
\Interligne}%

\def\etroit{\ifdim\Interligne<0.1pt%
\computewidths\fi
\elemskip=2\Interligne\relax
\def\notes{\vnotes 1.0\elemskip }%
\def\Notes{\vnotes 1.3\elemskip }%
\def\NOTes{\vnotes 1.8\elemskip }%
\def\NOTes{\vnotes 2.6\elemskip }%
\def\NOTes{\vnotes 3.6\elemskip }%
\def\NOTES{\vnotes 5.2\elemskip }}%

\def\vnotes#1\elemskip{\noteskip=#1%
\elemskip\n@otes}%
```

As seen above, if these standard spacings do not meet your requirements, you are welcome to define other spacings, using the more basic macro `\vnotes`.

However, you may also prefer to ask MusicTEX to compute the size of `\elemskip` from the page width (`\hsize`) after assuming a constant number of bars of a constant number of beats within each line⁴. In this case, you have better use the `\autolines` macro, which is described below (see : “Line and page breaking”).

2.4 Note pitch specification

Note pitches are usually specified by letters ranging from a to z for those which are usually written under the G-clef (a corresponds to the A of frequency 222.5 Hz ; the G of the G-clef is denoted g). Lower pitch notes are specified using uppercase letters ranging from A to N (the F of the F-clef is denoted M, and F is one octave below).

If necessary, a numeric symbol can be used to place a symbol independently of the active clef.

³To avoid problems with the LaTeX macro of the same name, this macros is only activated under LaTeX when `\begin{music}` is invoked.

⁴This does not meet the requirements of contemporaneous music, but fits very well to baroque and romantic music.

⁵The `\c` of this macro name is taken from the french word “croche” which is by the way one half of the english “crotchet” ; `\cc...`, `\ccc...` are standing for “double croche”, “triple croche”, etc.

Besides, notes below A (i.e. the A of frequency 55.625 Hz), namely the lowest octave of the modern pianos can only be coded using the transposition features (see below : *transposition* and *octaviation*) or in absolute vertical position using numbers.

2.5 Writing notes

There are two major kinds of note macros :

1. those which terminate a note/chord stem and cause horizontal spacing,
2. those which initiate or extend a note/chord stem and do not cause horizontal spacing.

The first kind is used to type a melody, the second kind is used to type chords.

2.5.1 Single (spacing) notes

`\wh p` : whole note at pitch *p*.

`\hu p` : half note at pitch *p* with stem up.

`\hl p` : half note at pitch *p* with stem down.

`\qu p` : quarter note at pitch *p* with stem up.

`\ql p` : quarter note at pitch *p* with stem down.

`\cu p` : eighth note⁵ at pitch *p* with stem up.

`\cl p` : eighth note at pitch *p* with stem down.

`\ccu p` : sixteenth note at pitch *p* with stem up.

`\ccl p` : sixteenth note at pitch *p* with stem down.

`\cccu p` : 32-th note at pitch *p* with stem up.

`\ccccl p` : 32-th note at pitch *p* with stem down.

`\ccccu p` : 64-th note at pitch *p* with stem up.

`\ccccl p` : 64-th note at pitch *p* with stem down.

As an example, the sequence :



was coded as :

```
\notes\cu c\temps\cl j\enotes\barre
\notes\ccu c\temps\ccl j\enotes\barre
\notes\cccu c\temps\ccccl j\enotes\barre
\notes\ccccu c\temps\cccccl j\enotes
```

If these notes are preceded by *non-spacing* notes (i.e. macros `\zq` or `\zh`) their stem is extended up or down so as to join all notes into a single chord.

2.5.2 Non-spacing (chord) notes

`\zcq p` : quarter (or shorter) note head at pitch p with no spacing after.

`\zh p` : half note head at pitch p with no spacing after.

It must be pointed out that the pitch p of these notes is memorized so that the stem of the further spacing note will join them into a chord. This stem top and bottom pitch is reset at each spacing note.

REMARK : Notes of duration longer than whole notes are always non-spacing. This saves one useless definition, since this notes are always longer than other simultaneous ones. If needed they can be followed by `\sk` to force spacing.

2.5.3 Shifted non-spacing (chord) heads

These symbols are used mainly in chords where second intervals are present. It is the responsibility of the typist to choose which heads should be shifted left or right.

`\xwp` : whole note head shifted right by one note width (ca. 6pt), no spacing.

`\lwp` : whole note head shifted left by one note width (ca. 6pt), no spacing.

`\xhp` : half note head shifted right by one note width (ca. 6pt), no spacing.

`\lhp` : half note head shifted left by one note width (ca. 6pt), no spacing.

`\xcq p` : quarter note head shifted right by one note width (ca. 6pt), no spacing.

`\lcq p` : quarter note head shifted left by one note width (ca. 6pt), no spacing.

Except that they are shifted left of right, these macros act like `\z...` macros for stem building.

2.5.4 Shifted notes

`\xqu` : acts like `\qu` but the note head is shifted one note width. This is used for chords whose upper note has to be on the right side of the stem.

`\xhu` : same as above for a half note.

2.5.5 Non-spacing single notes

`\zhu` : half note with stem up but no spacing. It acts like `\hu` for stem building.

`\zhl` : half note with stem down but no spacing. It acts like `\hl` for stem building.

`\zqu` : quarter note with stem up but no spacing. It acts like `\qu` for stem building.

`\zql` : quarter note with stem down but no spacing. It acts like `\ql` for stem building.

`\lhu`, `\lhl`, `\lqu`, `\lql` : same as above, but the whole of the note is shifted one note width on the left.

`\zw p` : whole note at pitch p with no spacing after.

`\zwcq p` : arbitrary duration note (◻) at pitch p with no spacing after.

`\zbpv p` : breve note (≡) at pitch p with no spacing after.

`\zsb p` : semi-breve note (≡) at pitch p with no spacing after.

2.5.6 Pointed notes

One simple way of doing consists in putting `\pt p` to get a dot after the normal notehead at pitch p . Thus a quarter note with a point can be coded `\pt h\qu h`.

A simpler way of doing consists in using compact macros, namely : `\cup`, `\cuppp`, `\cupppp`, `\zqp`, `\zhp`, `\zwp` (these three `\z...` are useful in chords), `\hup`, `\whp`, `\qhp`, `\qhpp`, `\qlp`, `\qlpp`, etc.

You may also introduce pointed notes, especially in groups by coding : `\qu{.a.^b.c}` which is equivalent to :

```
\pt{a}\qu{a}\pt{b}\sh{b}\qu{b}%
\pt{c}\qu{c}
```

2.6 Beams

Beams are not automatically handled, but they must be declared explicitly, before the first spacing note involving them is coded. Two kinds of macros are provided :

1. fixed slope beams have an arbitrary slope chosen by the user in the range -45% to +45% (by multiples of 5%) ;
2. semi-automatic beams have their slope computed knowing the number of `\noteskip` over which they are supposed to extend, and knowing the initial and final pitch of the notes they are supposed to link.

2.6.1 Fixed slope beams

`\ibu nps` : initiates an *upper beam* 3 horizontal line spacings above the pitch p . m is its reference number, which must be in the range [0-6] ([0-9] if `musicadd` file has been `\input`).

s is the slope of the beam. It is an integer in the range [-9,9]. $s = 1$ means a slope of 5%, $s = 9$ means a slope of 45% (the maximum with the `beamn20` or `beamn16` fonts), $s = -3$ means a slope of -15%, etc. With usual spacings a slope of 2 or 3 is fit for ascending scales. A slope of 6 to 9 is fit for ascending arpeggios.

`\ibl nps` : initiates a *lower beam* 3 horizontal line spacings below the pitch p . Other parameters as above.

`\ibbu nps` : initiates a *double upper beam* (same parameter meaning).

`\ibbl nps` : initiates a *double lower beam* (same parameter meaning).

`\ibbbu nps` : initiates a *triple upper beam* (same parameter meaning).

`\ibbbbl nps` : initiates a *triple lower beam* (same parameter meaning).

`\ibbbbu nps` : initiates a *quadruple upper beam* (same parameter meaning).

`\ibbbbl nps` : initiates a *quadruple lower beam* (same parameter meaning).

Beam termination is also not automatic. The termination of a given beam must be explicitly declared *before* coding the last spacing note connected to that beam.

`\tbu n` : terminates upper beam number n at current position.

`\tbl n` : terminates lower beam number n at current position.

`\tbu` and `\tbl` terminate beams of any multiplicity. Therefore 32-th notes hanging on a triple beam are initiated by `\ibbbu nps` and terminated by `\tbu n`.

It is also possible to code beams whose multiplicity is not the same at the beginning. The multiplicity can be increased at any position. For instance, `\nbbu n` which sets the multiplicity of upper beam number n to 2 starting at the current position, `\nbbbu n` sets its multiplicity to 3, and `\nbbbbu n` sets it to 4. `\nbb1 n` . . . `\nbbbbb1 n` perform the same functions for lower beams.

Notes hanging or standing on beams are coded in the form `\qhn p` and `\qbn p` where n is the beam number and p the pitch of the note head. MusicTEX adjusts the length of the note stem to link the bottom of the chord to an upper beam (normally with `\qh`) and the top of the chord to a lower beam (normally with `\qb`).

Note that the difference between upper and lower beams does not mainly consist in the beam being above or below the note heads ; rather, it specifies whether the abscissa of the beginning and the end of this beam is aligned on the right (upper beam) or on the left (lower) beam. Thus, the sequence :



has been coded as

```
\notes\ibu0e0\qh0e\nbbu0\qh0e\nbbbu0%
\qh0e\tbu0\qh0e\enotes
```

It is quite possible to terminate with `\tbu` a beam initiated with `\tbl`. This may give :



which has been coded as

Dutch TEX Users Group (NTG), P.O. Box 394, 1740 AJ Schagen, The Netherlands

```
\notes\ibl0p0\qb0p\nbb10\qb0p\nbbb10%
\qb0p\tbu0\qh0e\enotes
```

Partial termination of beams is also possible, by using `\tbbu` or `\tbl` : these macros terminate the current beam except that of order 1 (eights). `\tbbbu` or `\tblbb1` terminate the current beam except those of order 1 and 2, etc.

The macros `\tbbu` and `\tbl` may also be invoked when only a single beam is active. Then, a second beam (upper or lower according the initiating procedure) is opened *one note width before the current position, and closed immediately*. Thus the following sequence



is coded :

```
\notes\ibu0e0\qh0e\tbbu0%
\tbu0\qh0e\enotes
```

The same behaviour occurs in the case of `\tbbbu`, `\tblbb1`, `\tblbbbu` and `\tblbbb1`.

The symmetrical pattern is also possible. For example :



has been coded as :

```
\Notes\ibbb10j0\r1ap{\qsk\tbbb10}%
\qb0j\tbl0\qb0j\enotes
```

REMARK : these codings may seem complicated. In fact, it is the responsibility of the user to define macros which perform the most common sequences in his masterpiece. For example, one could define sets of four sixteenths by the macro :

```
\def\qqh#1#2#3#4#5{%
\ibbb10#2#1\qh #2\qh #3\tbl0\qh #4}
```

where the first argument is the slope and the other four arguments are the pitches of the four consecutive sixteenths wanted.

2.6.2 Semi-automatic beams

In order to avoid tedious checks to adjust the slope (and even the starting pitch) of beams in music with a lot of steep beams, a set of automatically slope computing has recently been implemented (file `musicvbm.tex`). If you say `\Ibu2g j3` MusicTEX will understand that you want to build an upper beam (beam number 2) horizontally extending 3\noteskip and whose first

note is a g and whose last note is aj . Knowing these parameters it will choose the highest slope number which corresponds to a slope not more than $(j - g)/(3\backslash\text{noteskip})$. Moreover, if there is no sufficiently steep beam slope available, then it will raise the starting point.

Eight such macros are available : `\Ibu`, `\Ibbu`, `\Ibbbu`, `\Ibbbbu`, `\Ibl`, `\Ibb1`, `\Ibbb1` and `\Ibbbb1`. Examples of their use is given in `marcello.tex`.

2.7 Phantom notes

It may be interesting, when coding a sequence of notes within a unique pair `\notes... \enotes`, to skip one note place in order – for example – to set the third note of one staff at the same abscissa as that of the second note of another staff. This can be done by inserting `\sk` which causes a spacing of one `\noteskip`⁶.

If you just want to shift a note or a symbol by one note head width, you may write `\qsk`.

Note that these two latter macros must be used inside a pair `\notes... \enotes`. If you want to make a spacing of one note head width outside, write `\nspace`.

2.8 Collective coding : sequences of notes

As seen in the MOZART example, it is not necessary to write a macro sequence `\notes... \enotes` for each column. If, on all staves of all instruments, spacings are equal or multiple of a unique value, the notes may be concatenated in each staff : each note in each staff makes the current position horizontally advance by the elementary spacing specified by the choice of `\notes`, `\Notes`, `\NOTes`, etc.

The major interest of this feature resides in that fact that the note macros are able to write several items ; for instance `\qu{cdefghij}` writes the *C-major* scale in quarters with stem up. In the same way `\cl{abcdef^gh}` writes the *A-minor* scale in eighths. Not all note generating macros can be used to perform collective coding, but most of them can. They are :

- all the spacing notes : `\wh`, `\hu`, `\hl...` `\cccc1` and the beam hooked notes, i.e. `\qhn` and `\qbn`.
- all the chord notes whose name is of the form `\z....`

Conversely, shifted notes are not supposed to be used in collective coding, mainly because they are used in very special cases which do not deserve wasting memory space to make them collective.

If necessary a void space can be inserted in a collective coding by using `*`.

⁶Do not use `\kern` nor `\hskip` : in fact `\sk` not only causes a space but also records that space for correct handling of beams.

2.9 Accidentals

Accidentals can be introduced in two ways.

The first way, the *manual* way of coding them, consists for example in coding `\fl a` to put a *flat* at the pitch a , supposedly before the further note of that pitch. There is no control upon the fact that a note will be put at this position and at this pitch. Naturals, sharps, double flats and double sharps are coded `\na p`, `\sh p`, `\dfl p` and `\dsh p` respectively.

Alternate procedures `\lfl`, `\lna`, `\lsh`, `\ldfl` and `\ldsh` place the same accidentals, but their abscissa is shifted one note head width on the left. The purpose of this is to avoid collision of accidentals in a chord with narrow intervals.

The second way of coding accidentals consists in putting the symbol `^` (sharp), the symbol `_` (flat), the symbol `=` (natural), the symbol `>` (double sharp), or the symbol `<` (double flat) within the coding of the note, e.g.: `\qh{^g}` yields a $G\sharp$. This may very well be combined with collective coding, e.g.: `\qu{ac^d}`.

Two sizes are available for accidentals. They revert to the small version when notes are supposed to be too close to each other. These two sizes can be forced by coding `\bigfl`, `\bigsh`, etc., or `\smallfl`, `\smallsh`, etc. If one does not want to have any small accidentals, then one can declare `\bigaccid` (conversely `\smallaccid` or `\varaccid` – the latter restoring variable sizes).

It is also possible to put (small) accidentals *above* the note heads. This is done using `\uppersh p`, `\upperna p` or `\upperfl p`.

2.10 Transposition and octavation

An important feature is the existence of a special register `\transpose` whose normal value is 0. If you say

```
\transpose=3
```

all subsequent pitches specified by upper or lower case letters will be transposed 3 positions. If you set `\transpose` to 7 you may write your music one octave below its final pitch. Thus, you can define *octavation* macros like

```
\def\soqu#1{\zq{#1}\transpose=7\relax
\qu{#1}}
```

to build quarternote octaves in a single call. Note that the octaviated note is coded within braces so that the transposition is only local.

Octavation can also be performed in is another way, namely using special codes to transpose by multiples of 7 intervals. For example `\qu{'ab}` is equivalent to `\qu{hi}` and `\qu{`kl}` is equivalent to `\qu{de}`. It should be emphasized here that the `'` (*acute accent*) and the ``` (*grave accent*) have cumulative ef-

fects, so that `\qu{' 'A'A}` is equivalent to `\qu{ah}` and that the `\transpose` parameter is only reset to its initial value (not necessarily zero) when changing staff or instrument (i.e. `|` or `&`) or at `\enotes`. Since this may be confusing, it is useful to use the `!` prefix to reset the `\transpose` register explicitly to the value it had when entering `\notes`⁷. Thus `\qu{!a'a}` always gives the note *a* and its upper octave *h* shifted by the value of `\transpose` at the beginning of the current `\notes... \enotes` group (or `\Notes... \enotes`, etc.) whatever the number of previous grave and acute accents occurring in-between.

The above processes indeed change the vertical position of the note heads and associated symbols (note stems, accents and beams) but they do not take care of the necessary changes of accidentals when transposing, i.e. the fact that an *F*♯ occurring with a zero signature should become a *B*♯ when transposing from the tonality of *C* major to *F* major where the normal *B* is the *B*♭. Since the intent of the composer is not obvious – he may want to shift a group of notes within the same tonality or conversely to transpose it in another tonality – this is not done automatically. Thus the `\sh`, `\fl`, `\na`, `\dsh` and `\dfl` symbols are not affected by a change of the `\transpose` register.

But the composer/typesetter may ask MusicT_EX to do that work. In this case, he should code `\Sh`, `\Fl`, `\Na`, `\dSh` and `\dFl` (or `\bigSh`, `\bigFl`, `\bigNa`, `\bigdSh` and `\bigdFl` or `\smallSh`, `\smallFl`, `\smallNa`, `\smalldSh` and `\smalldFl`) instead of the usual lower case accidental symbols. The symbol `\Sh` (resp. `\bigSh` and `\smallSh`) means that the corresponding pitch has to be raised by *one half pitch* with respect to its normal value according to the current signature. Thus `\Sh b` means a *B*♯ if the signature is zero or positive, and a *B*♯ if it is negative. The same logic applies for all accidentals having an upper case forelast letter.

Obviously, the computation is done after taking account of the value of the `\transpose` register.

The compact codes `^`, `,`, `=` are normally not affected by transposition and signatures, but their behaviour can be changed by saying `\relativeaccidentals` and reset by `\absoluteaccidentals` (the default situation).

Although *relative accidental coding* is an easy and safe way of coding *transposable* scores, care should be exercised in getting rid of the habit of saying `\na b` to rise the pitch of a *B* when the tonality is *F* major (i.e. with `\signaturen=-1` or `\generalsignature{-1}`). An example of sophisticated transposition is given in

the score `souvenir.tex` (which `\inputs souvenir.tex`).

Besides, the typical piano octave transposition `8-----` can be obtained by coding :

```
\octfin p n
```

which puts the 8 and dotted line symbols at the pitch *p* (usually *p* to *r*). The length is *n*`\noteskip`. This obviously fit for short octavation denotations. To transpose a whole line, use `\octline p`. Since `\octfin` terminates with a small hook down, to indicate clearly where octavation stops, you may also like to use `\octsup` which behaves like `\octfin` without the final hook. All this supposes you have an idea of the actual line breaking of your score in that section, and this is admittedly difficult to handle when octave transposition is supposed to long a large number of lines. In that latter case, you can use the `\def\everyline{...}` to insert whatever code you like at each new line of score. This has been used to set octavation in the score of the *Tocatta in F* by Charles-Marie WIDOR⁸ : at each bar (or virtual bar, namely `\zbarre`), the `\everystaff` procedure is updated to produce the convenient code, in case of the line breaking happening before the next definition.

2.11 Ties and slurs

They have been implemented in a way which may look rather ugly, but we think it is the only way of implementing *in one pass* ties and slurs which run *across glue*.

Slurs and ties must be initiated within the pair `\notes... \notes` before the spacing note is coded. They must be terminated also before the last note is coded.

```
\itenu np
```

(*ten* stands for the italian word *tenuto*) initiates an upper tie (convex) at pitch *p*. Just like beams, ties have a reference number *n*, from 0 to 6 (or 9 if `musicadd` is included). `\itenl np` initiates a lower tie (concave).

The tie of reference number *n* is terminated by `\tten n`.

Slurs are initiated with `\ilegu np` and `\ilegl np`, where *leg* stands for the italian word *legato*, and they are terminated with `\tleg n`. Except that slurs start before the note position and stop after, ties and slurs work the same way with the same syntax. They also share the same registers so that slurs nesting tied notes should have numbers *n* distinct from each other.

2.12 Bars and spacing

Ordinary *bars* a coded using the macro `\barre` (this is a french word⁹). This macro provides an optional (dis-

⁷This value is saved in another register named `\normaltranspose`.

⁸A French organist (1844-1937) and composer who was in charge of the organ of St-Sulpice in Paris, from 1864 to 1934.

⁹Whose advantage is that it differs from `\bar` which is already defined in T_EX.

cretionary) line or page break¹⁰. It also provides some *glue* in order to expand the text over an evenly filled line.

However, since the number of bars in a score line is generally small, it may be convenient to allow *glue* not only on each sides of *bars*. This can be done using the macro `\temps` (the french word for *beat*). This macro has two effects :

1. it inserts some *glue* but prevents line breaking¹¹,
2. if some ties or slurs are pending it expands them across the glue by writing an `\hrule` which overlaps the unfinished tie and makes it look prolonged.

Whatever the care you exercise in adjusting the size of the `\elemskip`, you are still likely to find some broken ties (which indicate excessive glue disassembling the gliding tie `\hrules`) or some unexpected (and unwanted) line breaks or some `Over[aw]full\hboxes`. A useful means of estimating the remaining space to be filled with glue consists in declaring `\raggedlinestruer`: after that, an `\hfil` will be inserted by MusicT_EX before each computed (when using `\autolines`) or forced line break. Thus, all the musical text will be packed on the left of the line and you will clearly see the amount of remaining space. Then, it will be up to you do decide changing some spacing parameters.

Important : *do not use `\temps` when beams are pending, otherwise their spatial synchronization would fail. In other words, ties and slurs can jump over glue (because horizontal rules may overlap and thus have some elasticity) but beams (as well as any oblique lines) cannot.*

Unless otherwise specified, bars are numbered. This is a good means of finding errors provided that the MusicT_EX user has put comments in his source text recording the (expected) bar number. However, this can look unpleasant for final outputs, since the habit is to number bars only each other five or ten bars. This is not a serious problem since the frequency of bar numbering is defined as :

```
\freqbarno{1}
```

If you replace the 1 by 5, bar numbering will occur each other five bars. Conversely, whenever you want to put the bar number, you just say `\wbarno`. You can also inhibit any bar number printing by telling

```
\def\wbarno{}
```

The bar counter is also accessible, its name is `\barno`. This has nothing to do the the bar counting invoked by

`\autolines`, so you can change it without any dramatic consequence.

2.13 Line and page breaking

Bars provide a line breaking mechanism which is supposed to enable T_EX to break a full score into lines and pages, with an optimal distribution of the text into lines and pages. Unfortunately, this does not work correctly for scores of more that approximately one page. The reason is that T_EX must compile the entire contents of a paragraph, before it tries to break it into lines and pages. Therefore, one cannot rely on T_EX to make that work which automatically results in the diagnostic `TeX capacity exceeded, memory...`

To circumvent this dramatically restrictive capacity¹² unless you use some BigT_EX¹³ another mechanism must be invoked to break lines.

The first one is the manual one : you replace some of the `\barre` macro calls by either `\alaligne` (equivalent to `\break` within text (in fact it contains a `\break` plus some (many) other things. In the same way, you can code `\alapage` to force an `\eject` with proper reinitialization of staves, clefs and signatures.

The second one is fit for scores whose bars are of regular length : after `\debutmorceau`, you code the following macro :

```
\autolines tml
```

where *t* is the number of *elementary spacings* (the length of `\notes... \enotes`) in an average bar, *m* is the number of bars you wish in a line and *l* is the number of lines you wish in a page¹⁴.

This sets some parameters, namely `\maxbarsinline` and `\maxlinesinpage` which are simply used to count the bars, optionally perform `\alaligne` or `\alapage` instead of the normal `\barre`. You may freely alter the values of these parameters, once they have been established by `\autolines`. Moreover, you can still force line breaking of page ejection using `\alaligne` or `\alapage` without problem since these macros actually reset the bar counters appropriately.

On the other hand, you may want to forbid line breaking at a bar, then you replace `\barre` by `\xbarre`.

Conversely, you may want to break a line *not at a bar*¹⁵. This is allowed by `\zbarre` (optional line break) or forced by `\zalaligne` or `\zalapage`.

The final heavy double bar of a piece is provided by `\finmorceau`. If you just want to terminate

¹⁰Unless it is triggered according to bar counting when `\autolines` has been invoked.

¹¹This could unpleasantly occur if you insert a space...

¹²T_EX has been designed to type text, not music.

¹³Whose drawback is that it is very slow on ordinary PCs.

¹⁴After having coded nearly one hundred of pages of music, I strongly recommend the use of `\autolines` except when inserting short excerpts of less than one line, such as in musicographic books.

¹⁵For example, you may prefer to turn the page at a place where the pianist has one hand free.

the text with a simple bar, you say `\suspmorceau`. If you want to terminate it without a bar, you code `\zsuspmorceau`. Once you have stopped the score by any of these means, you can restart it using `\reprmorceau`.

If you want the next vertical bar to be a double bar, you have to declare `\setdoublebar` before the `\barre` (or the `\suspmorceau` or `\alaligne` or `\alapage`) to be marked with a double thin bar.

2.14 Changing score attributes

As seen before, you can change the signature of the whole set of instruments by `\generalsignature n` where $n > 0$ means a number of sharps, $n < 0$ means a number of flats. Or, you may prefer to change the signature of only one or two instruments by the statement :

```
\signaturer=s
```

where r is the roman numeral of the instrument considered, and s its specific signature. Since you may change simultaneously (with respect to the score) but consecutively (with respect to your code) the signatures of several instruments, this change takes place only when you say `\changesignature` (within a bar) or `\changecontext` (after a single vertical rule) or `\Changecontext` (after a double vertical rule. In the same way, you may want to change the active clefs. This is done by

```
\cleftoksr={{s1}{s2}{s3}{s4}}%
```

where r is the roman numeral of the instrument, $s1$ specifies the clef of the lower staff, $s2$ the clef of the second staff, etc. One must always give four values with the above syntax, otherwise... $s1 = 6$ means the *bass* clef (*clef de fa* in french), $s1 = 0$ means the *violin* clef (*clef de sol* in french), $s1 = 1$ through $s1 = 5$ mean the *alto* clef set on first (lower) through fifth (upper line of the staff). As seen above in the case of signatures, several clefs may be changed at the same time ; thus all the clef changes become operational only when the macro `\changecler` is coded. Normal usage consists in issuing this command before the bar, not after (this helps the music player when the change happens across a line break).

Meter changes are implemented the same way :

```
\metertoksr={{m1}{m2}{m3}{m4}}%
```

where r is the roman numeral of the instrument, $m1$ specifies the meter of the lower staff, $m2$ the meter of the second staff, etc. One must always give four values with the above syntax, otherwise... Since meter changes are meaningful only across bars, they are actually taken in account with `\changecontext` or `\Changecontext` or `\alaligne` or `\alapage`.

2.15 Repeats

To insert a *repeat bar* you can use several sets of procedures. The simplest consists in using the commands

`\leftrepeatsymbol`, `\rightrepeatsymbol` and `\leftrightherepeatsymbol` – coded outside the `\notes... \enotes` pairs – which will simply insert these colon adorned double bars at the requested place. For example :



has been coded as :

```
\notes\hu g\enotes
\leftrepeatsymbol
\notes\hu h\enotes
\leftrightherepeatsymbol
\notes\hu i\enotes
\rightrepeatsymbol
\Notes\wh j\enotes
\suspmorceau
```

However, the previous way of coding does not provide for line breaking at repeat bars, nor does it advance the bar numbering. In fact, this way of coding if only fit for repeats occurring in the middle of a bar.

A second way of coding consists in saying `\setleftrepeat`, `\setrightrepeat` or `\setleftrightherepeat` before a bar (`\barre`), `\suspmorceau` or `\changecontext`). In this case, the next next vertical bar will be replaced with the selected repeat bar. This meets the traditional music typesetting conventions in the only case of the *right repeat* but, unfortunately, left and left/right repeats use to behave in a different manner when in the middle of a line and at a line break.

The third coding, namely the correct coding – i.e. transforming in the correct manner when occurring at a line break – is obtained by substituting the `\barre` command with `\leftrepeat`, `\rightrepeat` and `\leftrightherepeat`.

Now, if you want to force a new line at a repeat, you should code respectively :

```
\setrightrepeat\alaligne
\setrightrepeat\suspmorceau
\alaligne\leftrepeatsymbol
\reprmorceau\leftrepeatsymbol
\debutmorceau\leftrepeatsymbol
```

or the combination of two of these in the case of a left/right repeat.

2.16 Miscellaneous

Special macros are provided to help the composer to set any TEX text on the staves. The macro

```
\charnote p{ text }
```

sets the given text with its base line at pitch p of the current staff (this means it must be coded inside `\notes... \enotes`. Whatever the length of the

text, the spacing is `\noteskip`. If you do not want it to cause spacing, you code `\zcharnote`. If you want the possible spilling text to expand on the left rather than on the right, then you can use `\lcharnote`.

To place some text at the mid-position between the two staves of a keyboard instrument, you may code :

```
\midtwotext{ text } % (spacing)
\zmidtwotext{ text } % (non spacing)
```

being however careful, a) to put it inside `\notes... \enotes`, b) to code it in the text of the lower staff.

A text to be put above the current staff is introduced by `\uptext{...}`. This may however cause some collision with bar numbering or notes above the staff ; it is then wise to use `\Uptext{...}` which puts the text two pitches higher (recommended to post the tempo).

Metronomic indication deserves a special macro. The mention :

$$\downarrow = 60$$

is coded by `\metron{\hup}{60}` (normally embedded in `\Uptext` which is in turn embedded within `\notes... \enotes`).

The macro `\zcharnote` is fit for coding special notations like accents above or below the notes. It behaves like `\charnote` but causes no spacing.

Arpeggios (i.e. $\}$) can be coded with the macro

```
\arpeggio pm
```

where p is the pitch of the base of the arpeggio symbol and m is its multiplicity (one period is equal to one space between staff lines, i.e. 5 points). This macro causes a space of one note head width. It should be issued before the concerned chords. Its variant `\larpeggio` sets the arpeggio symbol slightly more on the left, in order to avoid collision with accidentals in front of the chords.

Trills can be coded in several ways. `\trille l` (where l is a TEX dimension) yields \sim while `\Trille l` (where l is a TEX dimension) yields $tr \sim$. To put these patterns at a given pitch, one may use `\xtrille pl` or `\xTrille pl`. On the other hand `\ntrille pn` is equivalent to `\xtrille p{n\noteskip}` and `\nTrille pn` is equivalent to `\xTrille p{n\noteskip}`

Other *ornaments* are available :

- `\mordant p` for ♯ ,
- `\pince p` for ♯ ,
- `\Pince p` for ♯ ,
- `\upz p` (upper *pizzicato*) to put a dot above a note

head at pitch p ,

- `\lpz p` (lower *pizzicato*) to put a dot below a note head at pitch p ,
- `\usf p` (upper *sforzando*) to put a $>$ accent above a note head at pitch p ,
- `\lsf p` (lower *pizzicato*) to put a $>$ accent below a note head at pitch p ,
- `\ust p` (upper *staccato* or *portato*) to put a hyphen above a note head at pitch p ,
- `\lst p` (lower *staccato* or *portato*) to put a hyphen below a note head at pitch p ,
- `\Upz p` (upper strong *pizzicato*) to put an apostrophe above a note head at pitch p ,
- `\Lpz p` (lower strong *pizzicato*) to put a reversed apostrophe below a note head at pitch p .

The procedure named `\everystaff` is executed each time a new system is typed. It is normally void, but it can be defined (simply by `\def\everystaff{...}`) to tell MusicTEX to post anything reasonable at the beginning of each system.

The procedure named `\atnextline`, normally void, is executed at the next computed (through `\autolines`) or forced line break (using `\alaligne` or `\alapage`). More precisely, it is executed after the break and before the next system is typed. Thus it is fit for posting new definitions of layout parameters, when no system is pending¹⁶.

2.17 Staff size

You may also want to write some parts of your score in 20pt staff size and in 16pt staff size. This cannot be done – at least presently – in the same system, but only for distinct parts of pieces. Changing the size is done by saying :

```
\musicsize=16\computespecifics or
\musicsize=20\computespecifics
respectively.
```

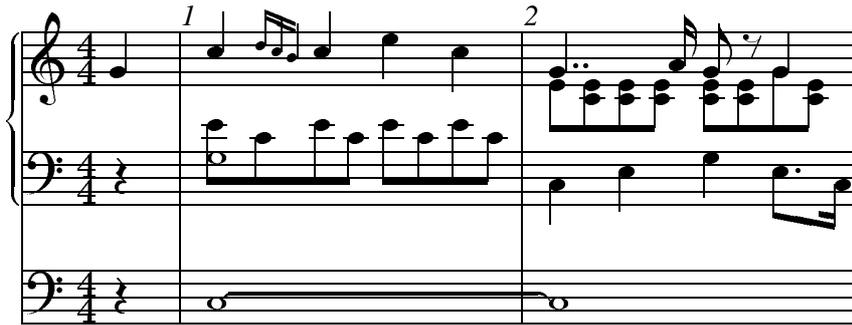
2.18 Small and tiny notes

Ornaments and *cadenzas* usually need to be written using smaller notes¹⁷. This can be done everywhere by stating `\smallnotesize` or `\tinynotesize`. Normal note size is restored by `\normalnotesize`.

These macros only have a local scope. Thus, if these macros are invoked outside the `\notes... \enotes` pair, the change is valid for the rest of the piece unless explicitly modified but, if they are invoked inside, their effect is local to the current staff of the current `\notes... \enotes` pair. As an example, the following excerpt (beginning of the Aria of the Creation by Joseph HAYDN)

¹⁶Its logic is similar to plain TEX's `\vadjust` command.

¹⁷This is independent of the staff size.



can be coded as :

```

\def\DS{\hbox{\ds}}
\def\FS{\hbox{\kern 0.3\noteskip\soupir}\kern -0.3\noteskip}
\def\qbl#1#2#3{\ibl{#1}{#2}{#3}\qb{#1}{#2}}%
\def\qbu#1#2#3{\ibu{#1}{#2}{#3}\qh{#1}{#2}}%
\def\nbinstruments{2}%
\generalmeter{\meterfrac{4}{4}}%
\signaturegenerale{0}%
\nbportesii=1\relax
\nbportesii=2\relax
\cleftoksi={{6}{0}{0}{0}}
\cleftoksii={{6}{0}{0}{0}}
\etroit
%
% end of preliminary definitions
%
\debutextrait
\NOTes\soupir&\soupir|\qu g\notes
% mesure 1
\advance\barno by -1\relax
\barre\NOTes\itenu2J\wh J&\zw N\ibl0c0\qb0e|\qu j\notes
\notes&\qbl0c0|\noteskip=0.6\elemskip\tinynotesize
\Ibulki2\qh1{kj}\tqhli\qsk\notes
\Notes&\qb0e\tbl0\qb0c|\qu j\notes
\temps\Notes&\ibl0c0\qb0{ece}\tbl0\qb0c|\ql 1\sk\ql j\notes
% mesure 2
\barre\Notes\tten2\wh J&\ql J\sk\ql L|\ppt g\rlap{\qu g}\qbl1e0\relax
  \zq c\qble\zq c\qble\relax
  \zq c\tbl1\rlap{\qble}\ \ \ccu h\notes
\temps\Notes&\ql N\sk\pt L\ibl0L{-4}\qb0L\ibl1e0\zq c\rlap{\qble}\cu g\relax
  \zq c\rlap{\qble}\raise\Interligne\DS \rlap{\qu g}\qblg\notes
\notes&\sk\tbb10\tbl0\qb0J|\tbl1\zq c\qble\notes
\finextrait

```

2.19 Layout parameters

Most layout parameters are set by MusicTeX to reasonable default values. However, sophisticated scores¹⁸ may need more place below the lowest staff, between staves, etc.

`\interligne` : vertical interval between lines
`\nullthick` : reserved height above base line for zero staff lines (text of songs)
`\bottommargin` : margin below the first staff of the lowest instrument. If not as-

signed a non zero dimension, it is set to `\bottomfacteur\Interligne` at the next system.

`\topmargin` : margin above the upper staff of the upper instrument
`\internote` : the half of `\Interligne`
`\interbeam` : vertical distance between beams
`\Interligne` : vertical distance between the base of staff lines (`\interligne` is the size of the blank space between lines. The difference is the line thickness `\lthick`).

¹⁸To our knowledge, the most complicated scores are those written for the piano, during the romantic and post-romantic periods.

`\interportee`: the distance between the top of one staff and the bottom of the next one. If not assigned a non zero value, it is set to `\interfacteur\Interligne` at the next system.

`\interinstrument`: the additional vertical distance between two different instruments. This means that the distance between the upper staff of the previous instrument and the lowest line of the current instrument is equal to `\interportee+\interinstrument`. This value is normally zero, but it helps putting additional space between distinct instruments for the sake of clarity. This is a general dimension which holds for each of the vertical spaces between instruments, except the upper one, in which case this interval is irrelevant. However, this parameter can be overridden for the space above a specific instrument. For example (see the example `angescao.tex`) one can state :

```
\def\interinstrumenti{5pt}
```

to force an additional spacing of 5 points above instrument *i*, whatever the value of `\interinstrument`.

`\systemheight`: the distance from the bottom of the lowest staff to the top of the highest staff of the upper instrument. This is the height of the vertical bars (single, double, repeats, etc.).

In addition, when handling notes of a given staff of a given instrument, the following dimensions are available (note these are not true registers, but *equivalenced symbols* through a `\def`):

- `\altitude`: the altitude of the lowest line of the lowest staff of the current instrument.
- `\altportee`: the altitude of the lowest line of the current staff.

Most of these values can be changed, but only between the end of the previous system and the beginning of the next one. This can be inserted between a `\susporceau` and a `\reprmorceau`, but it is wiser to say, for example :

```
\def\atnextline{\global %
\bottommargin=5\Interligne}
```

When doing so, the Music \TeX user should be aware that this could disturb pending *slurs* or *ties*, since the altitude of these is stored in an absolute way, starting from the baseline of the systems. Therefore, changing the `\bottommargin` dimension can also be made by means of `\advancebottom{< dimension >}` which updates all pending slur and tie altitudes by the given dimension. This has been used in `pacifiqn` and `pacifiqb`.

2.20 Music \LaTeX

As said before, the amount of memory used by Music \TeX makes it hardly compatible with \LaTeX . However, Nicolas BROUARD succeeded in building a `\musictex.sty` which is now included in the distribution. This is not recommended to make separate music scores. Its purpose is rather to provide a means of inserting short musical excerpts in books or articles written with `latex`. Then, the `\documentstyle` command should include `musictex` in the options.

The \LaTeX style file `musictex.sty` is the simple concatenation of the following files :

- `musicpre.tex`
- `musicnft.tex`
- `musictex.tex`
- `musicvbm.tex`
- `musicpos.tex`

In the case of a \LaTeX user wanting to use accidental transposition facilities, he should invoke `musictrp` in the options of the `\documentstyle` command. The `musicpos.tex` file merely overrides the `\catcodes` of the `|` and `&` symbols which are modified by Music \TeX . To have access to these symbols when coding music, one should then enclose the scores or excerpts within `\begin{music}` and `\end{music}`. But there is also another possibility, i.e. to say `\nextinstrument` instead of `&` and `\nextstaff` instead of `|`. And in case of \TeX capacity exceeded... use a “Big \LaTeX ” (after checking there is no visible error in the source code).

2.21 Implementation and restrictions

The macroinstruction file Music \TeX contains approximately 2500 lines of code, that is 80 000 bytes approximately. This requires your score to be compiled by the most extended versions of \TeX (65 000 words of working memory). It is therefore wise to set `\tracingsstats` to 2 in order to have an information about the memory used in each page. In desperate situations, we recommend using the “Big \TeX ” processors which, unfortunately, perform a great deal of disk input/outputs (on PCs) which make them awfully slow.

In particular, the number of registers it uses and the amount of memory used by \LaTeX macros makes it doubtfully compatible with \LaTeX , unless using Big \LaTeX .

Other precautions are necessary : beware of end-of-line spaces ; they corrupt layout and may cause unwanted line breakings after which music symbols seem to *float* in the air without staves. To avoid that, it is recommended to use `\relax` rather than `%` at the end of source lines, since it allows indentation at the following source line.

3 Installation

As seen before, all the files are available at *anonymous ftp* `rsovax.ups.circe.fr` (130.84.128.100) in the directory

[`anonymous.musictex`].

This directory normally contains `musictex.zip` which contains all the distribution for PC (MS-DOS) computers. This is only for `ftp`-ing convenience since all source files are directly available in the same directory.

The VMS files are also packed into `musictex.bck`. Notwithstanding the fact that files are packed together or not, the files provided are of two kinds :

1. the basic files ;
2. the example files.

All *basic files* are either of the form `music*.*` (excluding of course `*.zip` and `*.bck`) and `beamn*.*`. Other files (`*.tex` or `*.dvi`) are example files.

Fonts are provided as `*.mf` files but also as `*.tfm` and `*.pk` files for 300 dpi printers or previewers. Additional values of the dpi parameter are provided in `musicpk.zip`.

REMARK : introducing these files in a *format* (with INITEX) is a means of saving computer time.

4 Examples

Three examples are displayed in the following pages, namely a transcription for organ and song of the beginning of the *Aria* of *The Creation* by Joseph Haydn, a *motet* for Christmas by Praetorius – in the original

pitch and transposed down by one pitch in smaller size – and a transcription of a concerto for oboe by Benedetto Marcello.

REMARK : the examples are given at the end of the document because their require a BigLaT_EX to be produced. Thus a trial T_EX-ing with standard LaT_EX can produce anything but the large examples (they can be more easily produced using *plain T_EX* rather than LaT_EX).

People who want to produce some of the given examples should take care of the fact that many given files are supposed to be included (by means of `\input`) in other files. Thus the good files to be directly T_EX-ed are those which begin with `\input musicnft`.

Suggested tests are :

- PACIFIQN for a long original piano work (11 pages) ;
- HADAGIM for a typical organ score ;
- CARILLON for a sophisticated piano score (use BigT_EX !)
- PRAETORI to get an ancient polyphonic song with three transpositions ;
- ANGESCAM if you like Christmas carols with four voices, a three-staff organ score and the same transposed to meet ordinary singer's limitations ;
- HPRELFUG if you like imitations of J.-S. Bach...
- MARCELLO if you like pre-baroque musicé;
- RECUEIL if you want to get all the organ works of the author in a single book (43 pages) ;
- HCREATIM to get an unfinished transcription of the Creation by J. HAYDN.
- HWIDOR and NWIDOR to get the Toccata by Charles-Marie WIDOR in two different sizes.

```

\input musicnft
\input musictex
\input musicsty

\def\nbinstruments{2}%
\generalmeter{\meterfrac{4}{4}}%
\signaturegenerale{0}%
\hsize 190mm \vsize 275mm
\hoffset -10mm \voffset -10mm
\centerline{\enorme Aria No. 24}
\medskip\centerline{\moyen (La Cr\'eation)}
\medskip\centerline{\moyen Joseph HAYDN}
%
\rightline{Transcription pour Orgue et T\'enor, D. Taupin (1990)}
\medskip
\nbporteesi=1\relax
\nbporteesii=2\relax
\def\qbl#1#2#3{\ibl{#1}{#2}{#3}\qb{#1}{#2}}%
\def\qbu#1#2#3{\ibu{#1}{#2}{#3}\qh{#1}{#2}}%
\etroit
\def\DS{\hbox{\ds}}\def\FS{\hbox{\kern 0.3\noteskip\soupir}\kern -0.3\noteskip}
\cleftoksi={{6}{0}{0}{0}}
\cleftoksii={{6}{0}{0}{0}}
\debutmorceau
\NOTes\soupir&\rlap{\rmidtwotext{\bf II}}\soupir|\qu g\notes
% mesure 1
\advance\barno by -1\relax
\barre\NOTes\itenu2J\wh J&\zw N\ibl0c0\qb0e|\itenl0j\ibull0\qhlj\notes
\notes&\qbl0c0|\nbbul\nbbbu1\tten0\qhl1{jkj}\tbu1\qhl1\notes
\Notes&\qb0e\tbl0\qb0c|\qu j\notes
\temps\Notes&\ibl0c0\qb0{ece}\tbl0\qb0c|\ql 1\sk\ql j\notes
% mesure 2
\barre\Notes\tten2\wh J&\ql J\sk\ql L|\ppt g\rlap{\qu g}\qblle0\relax
\zq c\qble\zq c\qble\relax
\zq c\tbl1\rlap{\qble}\ \ccu h\notes
\temps\Notes&\ql N\sk\pt L\ibl0L{-4}\qb0L|\ibll0\zq c\rlap{\qble}\cu g\relax
\zq c\rlap{\qble}\raise\Interligne\DS \rlap{\qu g}\qblg\notes
\notes&\sk\tbb10\tbl0\qb0J|\tbl1\zq c\qble\notes
% mesure 3
\barre\NOTes\itenl2G\wh G&\zw N\raise 3.5\Interligne\ds
|\rlap{\cl f}\itenl0k\ibulm0\qhlk\notes
\notes&\qbl0b0|\nbbul\nbbbu1\tten0\qhl1{klk}\tbu1\qhl1{^j}\notes
\Notes&\zq d\qb0f\tbl0\qb0b|\qu k\notes
\temps\Notes&\ibl0d0\zq d\qb0{fb}\zq d\qb0f|\qu m\sk\pt k\qbulk{-4}\notes
\notes&\tbl0\qb0b|\sk\tbbu1\tbu1\qhl1\notes
% mesure 4
\alaligne\Notes\tten2\wh G&\ql G\sk\ql I|\rlap{\qupp g}\ibllc0\qblg\relax
\zq{bd}\qblf\zq{bd}\qblf\relax
\zq{bd}\tbl1\rlap{\qblf}\ \ccu h\notes
\temps\Notes&\ql K\sk\pt I\qbl0I{-4}|\ibll0\rlap{\qblb}\cu g\relax
\zq{bd}\rlap{\qblf}\raise\Interligne\DS \rlap{\qu g}\qblg\notes
\notes&\sk\tbb10\tbl0\qb0G|\tbl1\zq{bd}\qblf\notes
% mesure 5
\barre\Notes\hu J&\rlap{\lhu J}\ibl0M0\qb0J\zq N\qb0c\zq N\qb0c\tbl0\zq N\qb0c\relax
|\rlap{\hl e}\qu j\sk\qbull{-4}\tbu1\qhlj\notes
\temps\Notes\hu K&\rlap{\lhu K}\ibl0M0\qb0K\zq N\qb0b\zq N\qb0b\tbl0\zq N\qb0b\relax
|\rlap{\hl f}\ibulk0\qhl1{ikm}\tbu1\qhlk\notes
% mesure 6
\barre\Notes\wh L&\zw N\raise 3.5\Interligne\ds\qbl0c0\qb0e\relax
|\rlap{\hl g}\ppt j\qu j\notes
\notes&\tbl0\qb0c|\sk\ccu l\notes
\temps\Notes&\ibl0c0\qb0{ece}|\rlap{\hl g}\qu n\sk\raise 2\Interligne\DS\notes
\notes&\tbl0\qb0c|\ibbulm{-3}\qhlm\tbu1\qhl1\notes

```

music example

```

% mesure 7
\barre\Notes\wh M&\zw a\raise 3.5\Interligne\ds\qbl0d0\qb0f\tbl0\qb0d\relax
  |\rlap{\hlp h}\qu k\sk\qu m\enotes
\temps\Notes&\ibl0d0\qb0f|\pt o\qbulo{-3}\enotes
\notes&\zq d\qb0f\sk
\zq d\qb0f\sk\tbl0\zq d\qb0f|\sk\tbbul\tblul\qhl\relax
  \ibbulm{-3}\rlap{\raise -\Interligne\qp}\qhl{mlk}\tblul\qhlj\enotes
% mesure 8
\alaligne\Notes\hu G&\lcharnote c{\bf I}\relax
\pz b\ibl0M3\qb0N\pz d\qb0b\pz f\qb0d\pz d\qb0b|\ql i\rlap{\uptext{\bf I}}\sk\ds\ppz p\zq{km}\cl
\temps\Notes\hu G&\ibl0M3\pz b\qb0N\pz e\qb0c\pz g\qb0e\pz e\qb0c\relax
  |\zq{j1}\ql q\sk\ds\ppz l\zq{gj}\cl l\enotes
% mesure 9
\barre\Notes\hu G&\pz b\ibl0M3\qb0N|\zq{gi}\ql k\enotes
\notes&\nbb10\qb0b\qb0c\enotes
\zglu\Notes&\pz f\ibl0d{-4}\qb0d\pz d\qb0b|\ds\ppz p\zq{km}\cl p\enotes
\temps\Notes\hu G&\pz b\ibl0M3\qb0N|\ppz q\ibl1m3\zq l\qb1q\enotes
\notes&\nbb10\qb0c\qb0d|\nbb11\qb1q\qb1p\enotes
\temps\notes&\pz g\ibl0e{-4}\qb0e\sk\pz e\qb0c|\ibb11p0\qb1{qpq}\qb1s\enotes
% mesure 10
\barre\Notes\hu G&\zq{Nb}\ql d|\pz t\ibl1o{-3}\qb1r\enotes
\notes&|\nbb11\qb1n\qb1{^m}\enotes
\zglu\notes&\soupir|\ibb11m0\qb1{nmn}\qb1m\enotes
\temps\Notes\hpause&\ibl0I6\pz J\qb0G|\pz p\cl n\enotes
\notes&\nbb10\qb0N\qb0{^M}|\ibbulg{-3}\qhlg\qhl{^f}\enotes
\notes&\ibb10N0\qb0{NMN}\qb0M|\ibbulg0\qhl{gfg}\qhlf\enotes
\suspmorceau
\def\nbinstruments{4}%
\nbportesiii=0\relax
% mesure 11
\reprmorceau
\Notes\qu G&\ql N|\st n\qu g&\hpause\enotes
\zglu\Notes\soupir&\rlap{\rmidtwotext{\bf II}}\soupir|\zq d\qu{=f}&\enotes
\temps\Notes\hpause&\hpause|\zq c\qu e&\soupir\enotes
\zglu\Notes&|\zq b\qu d&Mit~\ilegu0p\qu g\enotes
% mesure 12
\barre\Notes&\qu J|\zw N\zq c\ibu0e0\qh0e\zq c\qh0e&W\"urd~&\ql j\enotes
\Notes&\soupir|\zq c\qh0e\zq c\qhl0e&und~&\ql j\enotes
\temps\Notes\pause&\hpause|\zq c\ibu0e0\qh0e\zq c\qh0e&Ho-&\ql l\enotes
\Notes&\zcharnote C{\bf I}|\zq c\qh0e\zq c\qhl0e&heit~&\ql j\enotes
% mesure 13
\barre\Notes&\qu C|\zw N\zq c\ibu0e0\qh0e\zq c\qh0e&an-&\qup g\enotes
\Notes&\qu E|\zq c\qh0e\zq c\qhl0e&\sk ge-&\sk\cu h\enotes
\temps\Notes\pause&\qu G|\zq c\ibu0e0\qh0e\zq c\qh0e&tan,~&\tleq0\qu g\enotes
\Notes&\ibulE{-3}\qhlE|\zq c\qh0e&mit~&\ilegu0p\qu g\enotes
\notes&\sk\tbbul\qhlC|\zq c\qhl0e&\enotes
% mesure 14
\barre\Notes&\qu G|\zw N\ibu0e0\zq{bd}\qh0f\zq{bd}\qh0f\relax
  &Sch\"on-&\ql k\enotes
\Notes&\soupir|\zq{bd}\qh0f\zq{bd}\qhl0f&heit,~&\ql k\enotes
\temps\Notes\pause&\hpause|\zq{bd}\qh0f\zq{bd}\qh0f&St\"ark~&\ql m\enotes
\Notes&|\zq{bd}\qh0f\zq{bd}\qhl0f&und~&\ibu2k{-4}\qh2k\qhl2i\enotes
\suspmorceau
\removelastskip\rightline{\sl\aujourd'hui}
\bye

```

Aria No. 24

(La Création)

Joseph HAYDN

Transcription pour Orgue et Ténor, D. Taupin (1990)

The musical score is presented in four systems. The first system (measures 1-3) features a treble clef with a 4/4 time signature and a 'II' marking. The second system (measures 4-7) continues the organ part. The third system (measures 8-10) includes a vocal line with lyrics and an organ part with 'I' markings. The fourth system (measures 11-14) shows the vocal line with lyrics and the organ part with 'II' and 'I' markings.

1 2 3

4 5 6 7

8 9 10

11 12 13 14

Mit Wü- rd und Ho- heit an- ge- tan, mit Schön-heit, Stärk und