J74 PitchControl

Real-Time Pitch Performance and Control

version 1.0

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About J74 PitchControl

J74 PitchControl is a Max for Live tool set for *real-time pitch treatment and harmonization*. It allows you to manipulate an audio input signal through pitch-processing stages such as tuning, re-pitching, space placement, vocoding, LFO de-tuning and to harmonize it up to four voices, all in real time, controlled by MIDI.

J74 PitchControl has been made primarily with the *human voice* in mind (although it can be used with anything else). While the tool can be used as a classic T-Pain style auto-tuning effect (for automatic pitch correction) or as a fixed harmonizer, its main goal is to do pitch manipulation and harmonization via *MIDI*: you can indeed play the device in real-time (improvising with a keyboard or other MIDI controller) or sequence it upfront, using Live MIDI clips, controlling tuning, vocoding and harmonization, all at the same time.

Audio signal path and (semi) modularity
The processing path available in J74 PitchControl is semi-modular. The tool is composed of several device types and uses a master-slave architecture to operate: the master processes MIDI and instructs the slave devices, which do the actual audio processing. From the master you can turn features on and off, as you like.

It is possible to have the audio slave functionality (Tuner, Harmonizer voices, VoCoder) *separated on individual tracks* (so that you can you add you own insert effects or group voices) or *aggregated in a single, "all-in-one" audio slave device* (quicker to setup, but offering slightly less granularity).

Applications
Here a list of applications the tool was thought for:

- Real-time audio input signal MIDI tuning (improvised or sequenced)
- Real-time audio input signal MIDI harmonization, up to four voices (improvised or sequenced)
- Vocoding, using an external (vocal) signal as modulator (with the internal carrier)
- All of the above, at the same time
- Real-time auto-tuning (scale or MIDI based)
- Real-time auto-harmonization, up to four voices (by selectable intervals)
- Virtual room mixing and spatial effects (pitch de-tuning, glide, sync and LFO modulation of pitch and delay)

CPU Usage
The tool does require a fair amount of CPU resources. The best approach to get this around is to record the results to audio, once you are satisfied with them (see last section of this user manual for tips on how to do that). If your source signal is a mono signal you can also reduce CPU usage (of about a third) by using the mono versions of the audio slave devices. The mono versions have the "-M" suffix in their name.

Latency
The tool introduces some latency due to the look-ahead needed to identify and process pitch. At 88Khz sampling rate this results in about 40ms of latency between the input and the processed output. Be aware of this if you decide to record the material as audio (re-align the recording appropriately).
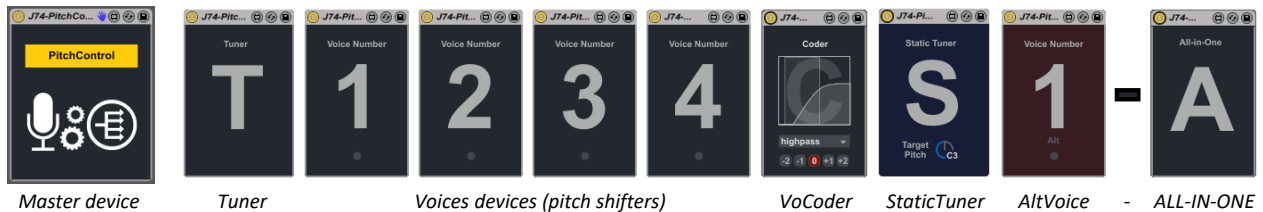
How to install J74 PitchControl

J74 PitchControl is a set of Max for Live devices for Ableton Live and requires a *Max for Live license* to run. The software will run properly only in Ableton Live 9 *or higher* (older versions of Live, such as Live 8, are *not* supported).

J74 PitchControl installation
Installation of the tool set is simple: *unzip* the download pack and copy the files to your computer hard drive. There you will find the plug-in devices (.amxd files), which you can drag and drop in your live set, as well as example (template) live sets and preset banks.

J74 PitchControl plug-in's: Master, Tuner, Voices, VoCoder, utilities and All-in-One (audio) device
The tool set is composed of several device types and uses a *master-slave* architecture to operate. The master processes MIDI and instructs the slave devices, which do the actual audio processing.

Master device — *Tuner* — *Voices devices (pitch shifters)* — *VoCoder* — *StaticTuner* — *AltVoice* - *ALL-IN-ONE*

- PitchControl **Master**: this is the *brain* for the whole set. It controls all settings of the other devices and processes MIDI input. The Master is a MIDI effect and does not produce or manipulate any audio by itself.

- PitchControl **All-in-one** audio device: if you do not need the modularity in mixing and like to use all features as an ensemble (tuning, harmonization and vocoding, all on the same track), you can use a single slave device, called "J74-PitchControl-All-Voices-in-One". Essentially this device aggregates all other devices and pre-mixes them in a single audio plug-in. This simplifies routing, although slightly limiting the granularity for certain applications. Note that it still needs the Master in order to be controlled.

- PitchControl **Tuner**: the Tuner is a *pitch corrector* slave device. It needs to be used on an audio track which receives the input signal at the beginning of the chain (e.g. a microphone signal or an audio clip with a recording). The device enforces tuning as instructed by the master device and produces audio output.

- PitchControl **Voice**: this is a *pitch-shifting* slave device commanded by the master. Up to four of these devices can be used at the same time, for a four part harmonization. Each Voice device goes on a dedicated audio track and needs to receive, as input, audio output (either from the Tuner device itself or, if in use, the Static Tuner device, mentioned next). For this, standard Ableton Live I/O audio routing can be used. Each Voice device produces audio.

- PitchControl **VoCoder**: a Vocoder module. This device allows you to perform vocoding on the original signal, using the harmonization MIDI to control its internal 4-voice synthesizer which acts as carrier.

- PitchControl **Static Tuner** Utility. Often, you may like to decouple harmonization from tuning. For this goal a Static Tuner device is provided in the set. All this plug-in does is to tune the pitch of the incoming signal to a selected target pitch, all the time (normally the root key of your composition). It can be used to create a reference pitch to feed the Voices and make harmonization independent from tuning.

- Two implementations of pitch-shifting Voice devices have made it to the final set: in the package, you will find indeed both the [J74-PitchControl-Voice.axmd] and the **Alternative Voice** [J74-PitchControl-VoiceAlternative.amxd]. These devices respond to the same controls, but provide a different flavor in their results. As a matter of fact, these devices are interchangeable and can be mixed up in the same setup: you can have voice 1 and 3 with one type, while voice 2 and 4 with the other for an organic result.

How to set up the plug-in's (a): Master + All-in-one easy combination

The simplest way to get started is to combine the *Master* (MIDI controller device) with the *All-in-one* (slave audio device, with processing for all functions combined). This combination provides you with essentially all the features in the set. This combination is also provided as a "Template" in the pack (see next chapter about templates).

Note: compared to a setup based on individual audio slaves, limitations regard the lack of separate audio tracks and a few specific routing options which require modularity (e.g. linking tuning to harmonization for gliding). Please check the "Techniques and Tips" chapter for knowing more about these scenario's.

Below a picture showing the configuration with the Master and All-in-one devices used together:
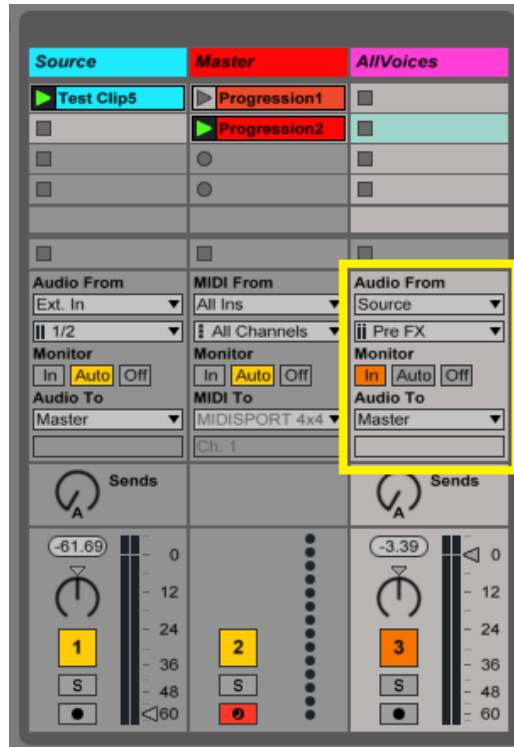
Notes about functionality and track routings:

* Track 1 is dedicated to the *Source signal*, either an external input from the audio interface, like a live microphone input, or a pre-recorded audio clip. Be sure the signal is "hot" enough to have tuning work properly (tip: you can use a compressor with make-up gain in order to do so).

* Track 2 hosts the *Master* device. MIDI is sent *directly* to the Master. The device does its MIDI processing and sends pitch information to the (All-in-one) slave audio device, *without* additional MIDI routing (using *internal messages* between devices). The [MIDI To] setting in the track is irrelevant.

* Track 3 holds the *All-in-one* audio slave device. On this track set [Audio From] to select the "Source" (Track 1 name), as input. This in fact routes the input signal (microphone/audio input or audio clip) to the input of the slave audio device. Also choose either [Post FX] (if you added any effect to Track 1, like a compressor) or [Pre FX] for the track routing input. Both settings allow you to get the source signal *before* the mixer fader of Track 1, so that you can set the volume of the source track to zero, but still use it for active/bypass or signal blending. Finally set the track to [Monitor In] so that audio can pass in from the input.


Tip: Please refer to the chapter "Techniques and Tips" for more details and alternative configurations.

How to set up the plug-in's (b): Using Templates

In this section we will see how to quickly add PitchControl processing chains by "drag & drop" of templates. The example live-sets in the pack have been included, not only to show up the various possibilities, but also to act as *templates* ready for you to re-use for your own projects.

Action Summary: In Live browser navigate to the project folder containing PitchControl templates/examples. From there, select the template live-set to use and *drag & drop it on the track area of the project*.

Below a picture visualizing this concept:
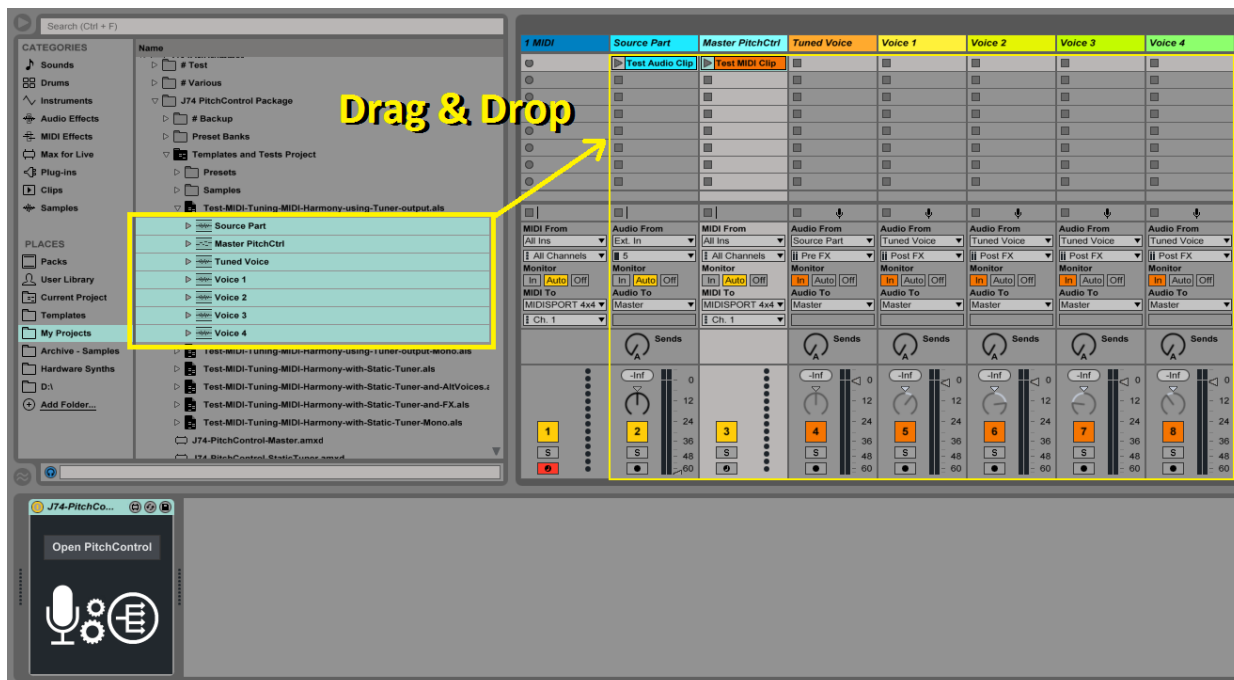
In detail:

- Unfold the project folder for the example/template you like to use. You will see the track names.
- Select with your mouse all the tracks (see picture above, highlighted area on the browser).
- Once all the tracks have been selected, *left-click on the selection* and *without releasing* the mouse button move the mouse pointer to the session view area, on a free section (= *drag action*).
- At this point *release the mouse button* (= *drop action*).
- The tracks will be added to your set with all the necessary configuration, plug-ins and routing.

Tip: this is sufficient to have the devices ready to use. Please refer to the chapter "Techniques and Tips" for a detailed explanation of the I/O routing involved in many of the possible applications.

Walk-through of J74 PitchControl features

All the controls of the J74 PitchControl tool set are placed on the Master device and the Master device is where you work on your sound design. The Master device is a MIDI plug-in which *processes MIDI* and acts as a *remote controller* of all the other devices, which actually perform the audio processing.

The user interface on the Master is divided in sections, reflecting the actual signal and processing flow.
The sections on the user interface are:

- **MIDI Input Processor**: this is the MIDI control area, operating on the MIDI input for both the Tuner and Harmonizer and providing controls for tuning octave, harmonizer voice handling and note on/off.
- **Audio Tuner**: this is the section which remote controls the Tuner device.
- **Room Placement**: this area works in conjunction with the Mixer area and controls placement of the voices in a virtual room. Position affects volume, panning, relative delay and tuning.
- **LFO and Vocoder**: an LFO with various shapes is available for modulation and can be used to affect the other sections, including targets for tuner pitch, harmonizer pitch and room delay. Simple controls for the vocoder are also available in this section.
- **Preset area**: a preset management area. Presets are useful for quick reconfiguration.

Below an all-in-one overview of the device set, as a quick reference.

Next a walk-through of the various sections and parameters in detail.

Walk-through: the MIDI Input Processor

At the beginning of the chain you find the "MIDI Input Processor", located at the top/left of the Master interface. This section defines what to do with the input MIDI and provides you with options for voice selection and handling.
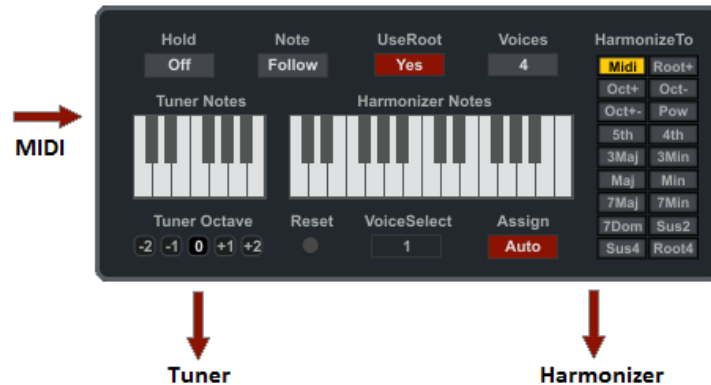
MIDI Split between Tuner and Harmonizer

The MIDI Input Processor defines a MIDI Split between Tuner and Harmonizer MIDI ranges. The split is defined by:

- Any note below C3 (from C-2 note 0, up to B2 note 59) is used for the Tuner pitch
- Any note above or equal to C3 (from C3 note 60, up to G8 note 127) is used for the Harmonizer

Notes about MIDI to the Tuner:

- MIDI to the Tuner is *monophonic* and enabled only if the Tuner is in [Tuning Mode] set to "MIDI".
- MIDI to the Tuner is *always hold* (note off events are ignored). Even if you release notes, pitch will be kept to the last selected note. This is actually useful as you do not need to keep holding a note down to set the pitch. Of course the pitch is applied by the Tuner device only when an audio signal is sent in input to it.
- MIDI to the Tuner has *immediate effect*, even while a signal is being processed and also if harmonization notes are still being hold. This allows you to change pitch on the fly, while in the middle of words. Combined with glide control this can give a legato effect.

Notes about MIDI to the Harmonizer:

MIDI to the Harmonizer is *polyphonic*, with polyphony defined by the [Voices] parameter, supporting MIDI *velocity* as mapped to the relative volume of the voices, in real-time. The actual note (and tone) produced by the Harmonizer MIDI *depends* on the setup in use:

- If the *Tuner* is used to feed the Voices and set to [Tuning Mode] = "Scale", notes are *relative intervals from the Tuner's pitch*, being C4 in the Harmonizer MIDI range the tonic. So, if the pitch is auto tuned to a D, holding a C Major shape on the Harmonizer will produce a D Major chord (shape of C Major, taken from the D). Holding the same shape when the Tuner goes to a G, produces a G Major chord and so on.

- If the *Tuner* is used to feed the Voices and set in [Tuning Mode] = "MIDI", notes for the harmonizer will be in general *absolute notes* (so if you play a C Major chord on the Harmonizer MIDI range, this will generally produce a C Major chord harmony). Anyway, if the Tuner root changes *while* Harmonizer MIDI notes are still being held, these notes will be temporary moved of the same interval as the Tuner new pitch moved. This effect is momentary and stops once all the harmonized notes are released. Note also that the Tuner's *timbre* will influence the harmonization *timbre*, being the Tuner output fed to the Voice devices as input.

- If the *Static Tuner* (later on this manual about it) is used to feed the Voices, notes will always be absolute, independently from any other event.

- If the *All-in-One* device is used an internal static tuning module makes sure notes will always be absolute, independently from any other event.

Here the detail of what the parameters on the MIDI Input Processor do:

- [**Hold**] if activated allows to hold input notes in the Harmonizer section, even if notes are released.

- [**Note Follow/Trigger**] defines if the Harmonizer MIDI input notes are followed in pitch or only used as triggers for an additional copy (over-imposed) of the tuner's note. The default is to follow MIDI input, which is good for most applications. See tips below for suggestions on how to use this parameter.

- [**UseRoot**] defines if it is allowed to use in harmonization the same note as used for the Tuner root (pitch). The default is to accept the root note also for harmonization.

- [**Voices**] defines the number of available Voices for the Harmonizer. By default this follows the number of Voice devices being detected. You can overrule this if you temporary want less voices.

- [**Tuner Octave**] transposes MIDI towards the Tuner, respectively of -2/-1/0/1/2 octaves. 0 is the default.

- [**Voice Assignment**] in Auto mode assigns the harmonized note to the next available Voice device, automatically. This is the mode you should use by default. In Manual mode you can use the [**VoiceSelect**] in clip envelope/automation to specifically select which voice will sing the next harmonized note.

- [**Reset**] is the classic "panic" button. It also restarts communication with the slave devices, if needed.

- [**HarmonizerTo**] This table/menu defines the way the Harmonizer work. If set to MIDI (which is the default) the device follows MIDI input for harmonization. If set to any other value, harmonization is done on using fixed shapes based on the selected musical intervals. See suggestions below on how to use this parameter.

Notes and tips:

- Enable [Hold] to keep the harmony always on. Disable [Hold] if you want to add harmonies only at specific points in the performance.

- Use [Note Follow/Trigger] to "Trigger" only if you like to use the virtual Room Placement as for effects (reverberation, de-tuning, chorusing, flanging, etc). This way multiple copies of the (Tuner's) output will be stacked upon each other, with de-tuning, positioning and delay applied for thickening the sound.

- Disable the [UseRoot] parameter if you want harmonization to happen only on notes different than the lead / root part (Tuner's pitch), filtering out any accidental copy fed to the Harmonizer as MIDI input.

- [Voice Assignment] set to "Manual" is useful only if MIDI to the Master is sequenced. This way you can select which voice (track) a particular note will be sent to at any given time. Use Auto in any other case.

- It can be useful to use the [HarmonizerTo] to one of the fixed interval shapes (anything different from "MIDI"). If you are doing auto-tuning (being [Tuning Mode] set to "Scale") some intervals and scale combinations will work better than others, depending on the harmonic content of the source material. For instance a 4th or 5th fit normally well. The Minor and Major chord shapes instead may be a little more tricky to fit in (but may work well if the "MajMin" scale is chosen, a scale limited to the root, 4th and 5th).

Walk-through: the Audio Tuner

The Audio Tuner section remote controls the actual Tuner module (Tuner device itself or the corresponding module in the All-in-One device). This is where you define the tuning mode of operation (MIDI vs auto-tuning) and the other options.
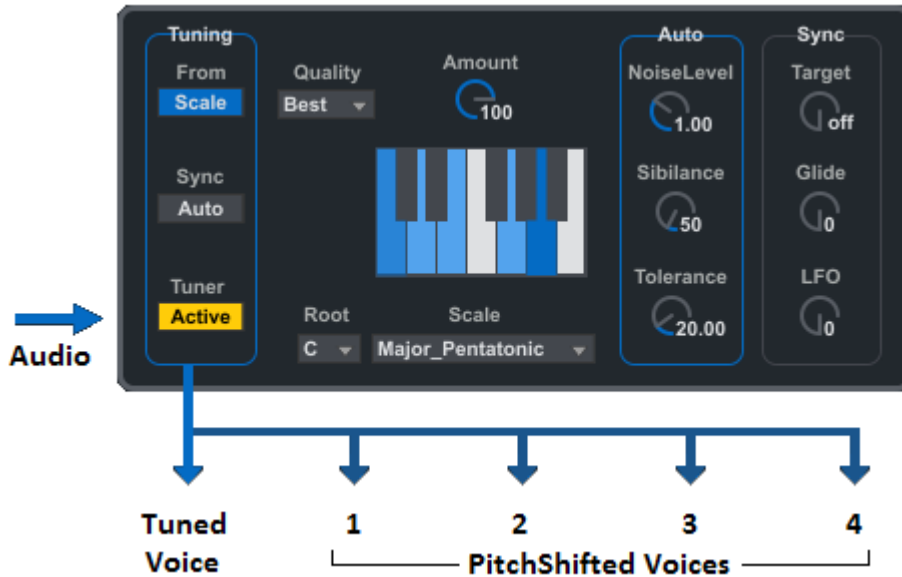
[**Tuning Mode**] defines how the Tuner works. In "MIDI" mode the Tuner ignores the Scale and Root settings and tunes the pitch based *only on input MIDI notes*. In "Scale" mode the Tuner works in *auto-tuning fashion*, based on the selected Root and Scale.

Only if [Tuning Mode] is set to "MIDI" you can use the [**Sync**] control. [Sync] defines how hard MIDI needs to be used for pitch control. With [Sync] set to "Auto" the MIDI input selects only the note, but not the octave, generally resulting in a more natural effect. With [Sync] selecting "ToMIDI", MIDI input defines *both* note *and* octave, for very hard pitch sync. The latter option opens up the use of pitch [Glide] and [LFO] features to the Tuner.

Notes about [Tuning Mode] and [Sync] combinations:

- Use [Tuning Mode] = "MIDI" + [Sync] = "Auto" if you want to steer the source signal using a known melody (to be played or sequenced via MIDI), while still retaining resemblance with the original part.

- Use [Tuning Mode] = "MIDI" + [Sync] = "ToMIDI" for a more extreme, synthetic effect. This combination tunes the pitch of the signal the "hard way", allowing the use of the [Glide] and [LFO] features on top (features otherwise not available in any other mode).

- Use [Tuning Mode] = "Scale" if you wish to auto-tune the input signal.

With [Tuning Mode] set to "Scale", the [**Root**] and [**Scale**] settings determine the harmonic key in use. In general all scales are fixed in configuration (that is, they are not editable). The exception is the "Chromatic(custom)" selection. When "Chromatic(custom)" is selected it is possible deselect/select any note (by clicking them), limiting auto-tuning to a custom combination of notes.

In the Tuner [**Quality**] defines the precision of the tuning mechanism. "Best" as [Quality] selection demands the highest CPU ans is selected by default.

The two sub-sections on the right side of the Tuner are active depending on the mode of operation. The "Auto" sub-section applies only if auto-tuning is selected (although it has some limited effect also in MIDI mode if Sync is left to Auto). The "Sync" sub-section instead works only if the Tuner mode of operation is [Tuning Mode] = "MIDI" + [Sync] = "ToMidi".

In detail, the parameters in the "Auto" sub-section influence auto-tuning as follows:

- [**Noise**] as the minimal level a signal must have to be recognized as pitch

- [**Sibilance**] as the distance in pitch to be found in order to allow a change in pitch decision

- [**Tolerance**] as the amount of tolerated pitch distance from perfect pitch before pitch correction engages.

Below a graphic representation of the parameters above. Further a table with suggested settings for a few applications, showing the [Scale] type and values for [Noise], [Sibilance] and [Tolerance].
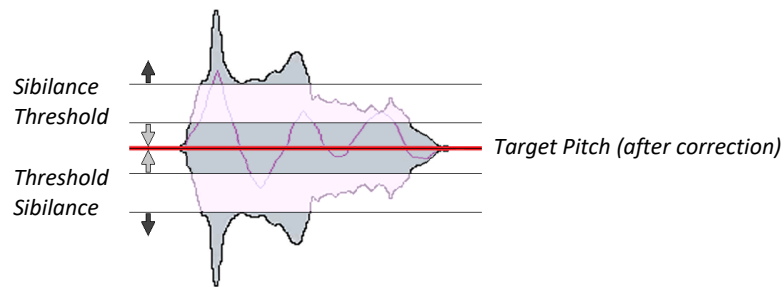
	Scale	Noise Level	Sibilance	Tolerance
Gentle	Chromatic	0.2	50	20
Precise but still Gentle	Non Chromatic scale	0.2	50	20
Aggressive	Non Chromatic scale	0.2	50	0
Aggressive Auto-Harmony	MajMin	0.2	100	0
Very Aggressive	Non Chromatic scale	0.2	100	0
T-Pain style	Non Chromatic scale	0	500	0

The parameters in the "Sync" sub-section (available only if the [Tuning Mode] = "MIDI" + [Sync] = "ToMIDI" combination) provide instead the following controls:

- [**Glide**] performs pitch gliding between any subsequent pitch selection, as by MIDI input.

- [**LFO**] applies an amount of vibrato (pitch modulation) to the Tuner's pitch, based on the LFO settings.

- [**Target**] in this mode it is actually auto-modulated by MIDI input, but can be used (even in any mode) as an extreme effect if altered.

Notes and tips:

- In order to work correctly, the Tuner must have a relatively "hot" signal. If the signal is too low, it may cause the Tuner pitch detection to consider it as noise. Therefore be sure to get a signal level loud enough for the Tuner to have it to work in its comfort area. See at the end of the manual for tips about input level.

- The Tuner works well for about an octave up or down the natural tone of the input signal. So try to play harmonies with notes not too distant from the natural tone of the input signal.

- Unlike the Tuner, the Voice devices (pitch-shifters) have no dedicated section in the Master but they are controlled solely by MIDI input (plus Room Placement and LFO controls, which are described next).

The Static Tuner utility
The Static Tuner utility only purpose is to tune the pitch of an incoming signal to a selected target pitch, statically, whatever the pitch of the incoming signal is. Although this may appear useless at first, it is actually useful: it can be used to create a *reference pitched signal as source for harmonization*.

The only control present on this device is the [**Target Pitch**], which is any note between C1 and C4.
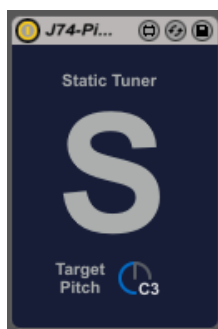
The main application of the Static Tuner utility is to be an alternative feed for the harmonization Voices, instead of the Tuner's output, as we described before. This will create a fixed pitch reference signal for harmonization to work on, independently from Tuner's pitch. In the "Techniques and Tips" chapter at the end of this manual detailed instructions on how to use it in this context will be provided.

The All-in-One audio device
The all-in-one audio device aggregates all the voices (Tuned Voice, Harmonization Voices and VoCoder), pre-mixing their signals in a single audio plug-in. As the other slave devices, this plug-in has no on-board parameter and is entirely controlled by the Master device.

The main benefit of using this device instead of the individual slaves is that it definitively simplifies routing and setup (only two tracks are needed). Anyway its fixed internal configuration limits slightly the granularity for certain specific applications (e.g. feeding the Tuner's output to the Voices for relative pitc-shifting and/or glide) and imposes the CPU usage of a full setup, even if you use a sub-set of the features (all the voices are there).

Tip: if you are not into modularity or just like to quick sketch ideas, the all-in-one audio device may be your best option. Once you found a sound that you like, if you still want to, you can always remove the all-in-one device and go modular. The Master device will be able to retain the overall configuration (which you can push again simply pressing the [Reset] button of the Master.

Walk-through: the Room Placement and Mixer area

The Room Placement area presents the possibility to assign the position of the harmonization voices (1/2/3/4) in space, in relation to the source (Tuned) voice and the "listening point" (virtually just in front of the Tuned voice at the top / center of the room, facing down to all other voices). The position of a voice affects its volume, panning, delay and tuning in relation to the selected mode of operation.

How to move voices: the Room Placement area presents you with four "circles" corresponding to the harmonization voices (numbered accordingly 1 to 4). If you wish to move a voice, click and hold on the voice (circle) in question and move it to the place you wish it to be set. Note though that this applies only to the harmonized voices (1/2/3/4) but not to the Tuned voice (T), the position of which cannot be altered.

In the default settings, with [**Mixer Menu**] set to "Room Mixer" and [**Delay Menu**] set to "Room Delay", the position of a voice affects its volume, panning and delay. This way:

- If a virtual voice is moved away from the "listening point" (in front of T), it will arrive attenuated in relation to its distance from T.
- If a virtual voice is moved away from the "listening point", it will arrive delayed in function of the distance.
- If a virtual voice is moved to one side (L/R) of the "listening point", it will arrive with asymmetric panning.
- The results for volume and panning are automatically set on the Mixer section, which remote controls Ableton Live's track Volume and Pan parameters.

In the virtual room, the [**Size**] parameter affects the size of the room and consequently the amount of the above effects. The [Size] defines the distance expressed in milliseconds, from the top side to the bottom side.

On top of these effects, a [**Detune**] additional parameter can be used to apply a slight amount of de-tuning to the pitch of each voice expressed in cents of a semitone. This is actually equivalent to a virtual voice moving around.

The [**Mixer Menu**] can be set to other settings to limit the way positioning affects the Volume and Pan for each virtual Voice. By default, with "Room Mixer" selected, the mixer volume and pan controls are slaved to the room position. Setting the voice on a specific position directly moves the mixer voice volume and pan controls. When set to "Manual Mix" the connection to the room position is broken and the position has no effect on volume and pan. The values on the Mixer can be set freely. With "Pan Mixer" selected, room position only affects the Pan value.

On the Mixer itself volume fader and panning dial are self explaining. The letter on each channel (T/1/2/3/4) actually doubles as [**Mute Button**] for the respective voice: you can click on it to Active/Mute the respective channel (this is actually true also for the "Vocoder Tone / Noise" on the LFO and FX section, as we will see later).

The [**Delay Menu**] defines if positioning affects the delay of each virtual Voice (T/1/2/3/4) and how. By default this is set to "Room Delay" and a delay is added based on the distance from the listening point (T). With "Beat Delay" being selected, the distance is quantized to time intervals from 1/32n to 1n, including triplets values. Finally the "No Delay" selection removes any relative delay from the voices.

Walk-through: the LFO and FX section

An internal LFO is available for modulating the pitch of the Tuner and the harmonized voices. It can be used this way for creating effects such as vibrato, stereo channel widening and de-tuning (thickening). In addition the LFO can modulate the delay time (being delay based on a digital "audio buffer") for glitch-y granular effects.

The LFO section is divided in three parts. At the top you will find the parameter defining the LFO signal itself, like the shape and its rate of oscillation. On the bottom/left you find the sub-section dedicated to "Pitch" which in this context is only the pitch of the harmonized voices (for the modulation the Tuner's pitch see the Tuner section). Finally on the bottom/right you see a sub-section dedicated to the "Delay" modulation, which in this context refers to the "audio buffers" used by the harmonized voices in Room Placement. Let's see in detail what the controls do.

The LFO top controls provide a way to shape the LFO itself:

- The [**Type**] selects among Sine, Square or Random shapes
- The [**Rate**] specifies the LFO Rate expressed in Hz (from 0.03 Hz up to 5Hz).

The "Pitch" sub-section of the LFO defines the amount of effect to the pitch-shifted harmonized Voices (1/2/3/4):

- [**Intensity**] defines the amount of vibrato (pitch fluctuation) applied to each voice, with initial LFO phase of each voice being affected by the room position.
- [**Spread**] slightly de-tunes the LFO for the Left and Right stereo channels, widening the stereo effect.

The "Delay" sub-section of the LFO defines instead how the LFO affects the room delay, from the Room Placement:

- [**Intensity**] defines the amount of time shifting to each delay line, effectively performing granular movement of the play position in the related delay audio buffer.
- [**Spread**] applies slightly different delay times to Left and Right stereo channels, widening the stereo effect.

Note: as mentioned in the Tuner section, the [**LFO**] control in the Tuner "Sync" sub-section applies an amount of vibrato (pitch modulation) to the Tuner pitch, based on the LFO settings. This only applies if the [Tuning Mode] = "MIDI" + [Sync] = "ToMIDI" combination is used on the Tuner.

Controls for the VoCoder device in the LFO and FX section
In the LFO and FX section you will also find two additional controls: the [**VoCoder Tone**] and [**VoCoder Noise**]. These are remote controls for the VoCoder device [J74-PitchControl-VoCoder.amxd]. They respectively define the volume of the oscillators and the volume of the noise of the internal synthesizer in the VoCoder device used for vocoding. Note also that the "Vocoder Tone / Noise" title doubles as a [**VoCoder Mute Button**] as well.

The VoCoder device: a vocoder module
The VoCoder device itself is a little vocoder which can be used as an additional (harmonization or solo) module in the set. The VoCoder device hosts a simple internal synthesizer which is used as *carrier*. The *modulator* is the signal received in input by the VoCoder device.

The internal synthesizer has four para-phonic voices, based on the combination of a saw oscillator and noise source (the mix of which is controlled by the [VoCoder Tone] and [VoCoder Noise] parameters in the Master device, LFO and FX section).

The synthesizer also provides a multi-type two-pole filter (with high-pass, low-pass, band-pass, notch among the options) and a control for defining the octave position for the MIDI input. The Master harmonization MIDI range drives the four vocoder synthesizer voices.
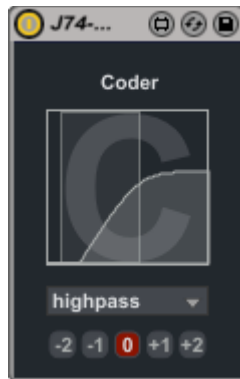
Note: the All-in-one audio device contains internally the same vocoder as the VoCoder separated device, with filter and octave parameters being fixed (to high-pass mode and default settings).

Walk-through: the Preset area

The Preset section provides a way to "jump around" to completely different settings and reconfigure all parameters in one go. A bank of presets can be loaded and saved as a file (with .maxpresets extension).

The Preset areas presents the following controls:

- The largest section, represented by a 13 x 6 preset slot grid, is for the actual presets. Each block corresponds to a preset slot. If dark, the preset is empty. If gray the position holds a preset, but the preset slot is not active at this time. If light blue, a preset is present and active.
- To select (activate) a preset CLICK on it. To store a preset on a slot hold SHIFT and CLICK on the slot. To delete a preset from a slot position, hold ALT+SHIFT and CLICK on the slot.
- With the preset a [Preset Name] (on top) and a [Preset Note Field] (on the bottom) can be freely assigned as text items. This way you can add a bit of information about what the preset actually does.
- Finally use the [Write] / [Read] to export and import a bank of presets to a file. In this case be sure to use the ".maxpresets" file extension, otherwise your bank will not be recognized if opened again. Notice also the [Clear] button, which has the effect of erasing the entire memory.

Note: it is possible to use Live standard preset management. Saving the device will store all its settings. This also applies to saving the J74 PitchControl devices in a live-set: all settings will be saved with the live-set and recalled when the live-set is opened again. Notice anyway that this does not apply to a loaded preset bank file, which can only be loaded and saved with its own [Write] / [Read] commands.

Other options in J74 PitchControl
An additional control is available, placed on the top/right corner of the Master user interface: the [**Float**] control defines how the window of the PitchControl Master floats in Ableton Live. If set to "Float" this let's the Master window go back from focus if you click anywhere else. You can then get the window back in front be either selecting the track where the Master device is set into or clicking anywhere on the Master docked device, in the track. If set to "OnTop" the control forces the Master window to remain in the foreground independently from what you do.

Now that reviewed all the controls, let's have a look to some useful techniques, examples and tips.

Techniques & Tips

[Example / Template] All-in-one audio device + Master device
This example / template shows the use of the Master device in combination with the "All-in-One" (slave) audio device, which combines all the voice functionality (tuning, harmonization, vocoding) in a single slave plug-in. Using this combination you will have all the essential features (apart from modularity) in the simplest possible setup.

Below a picture showing the configuration for this case (note: it is recommended to open the corresponding live set while reviewing an example. The example live-sets are clearly named after the example name in this user manual):
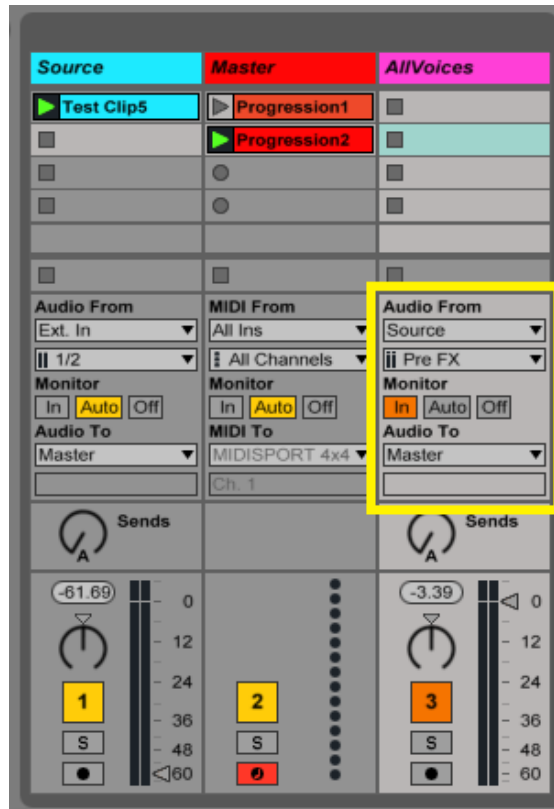
- As you can see the first audio track (Track nr. 1) is dedicated for the *source* (pointing to an external input from the audio interface, e.g. a microphone or just using a pre-recorded audio clip).
- Track nr. 2 hosts the *Master* device. MIDI is sent *directly* to the Master device, which does its MIDI processing and sends pitch data to the slave device (the All-in-one audio device), without additional MIDI routing (using *internal messages* between devices). The [MIDI To] setting is indeed irrelevant.
- Track nr. 3 in the picture holds the *All-in-one audio (slave) device*. On this track set the [Audio From] to select the "Source" (Track 1 output), as input. This in fact routes the input signal (microphone or clip) to the input of the device.
- Also notice how the [Pre FX] option is selected on this track input. This allows you to get the Source signal unprocessed (before any effect or mixer fader), so that you can apply processing and/or set the volume of the source track without affecting the signal fed to the slave device audio track. [Post FX] is also an option.
- Finally the track is set in [Monitor In] (orange) to allow audio to pass in.

The following picture shows you the logic in this setup.
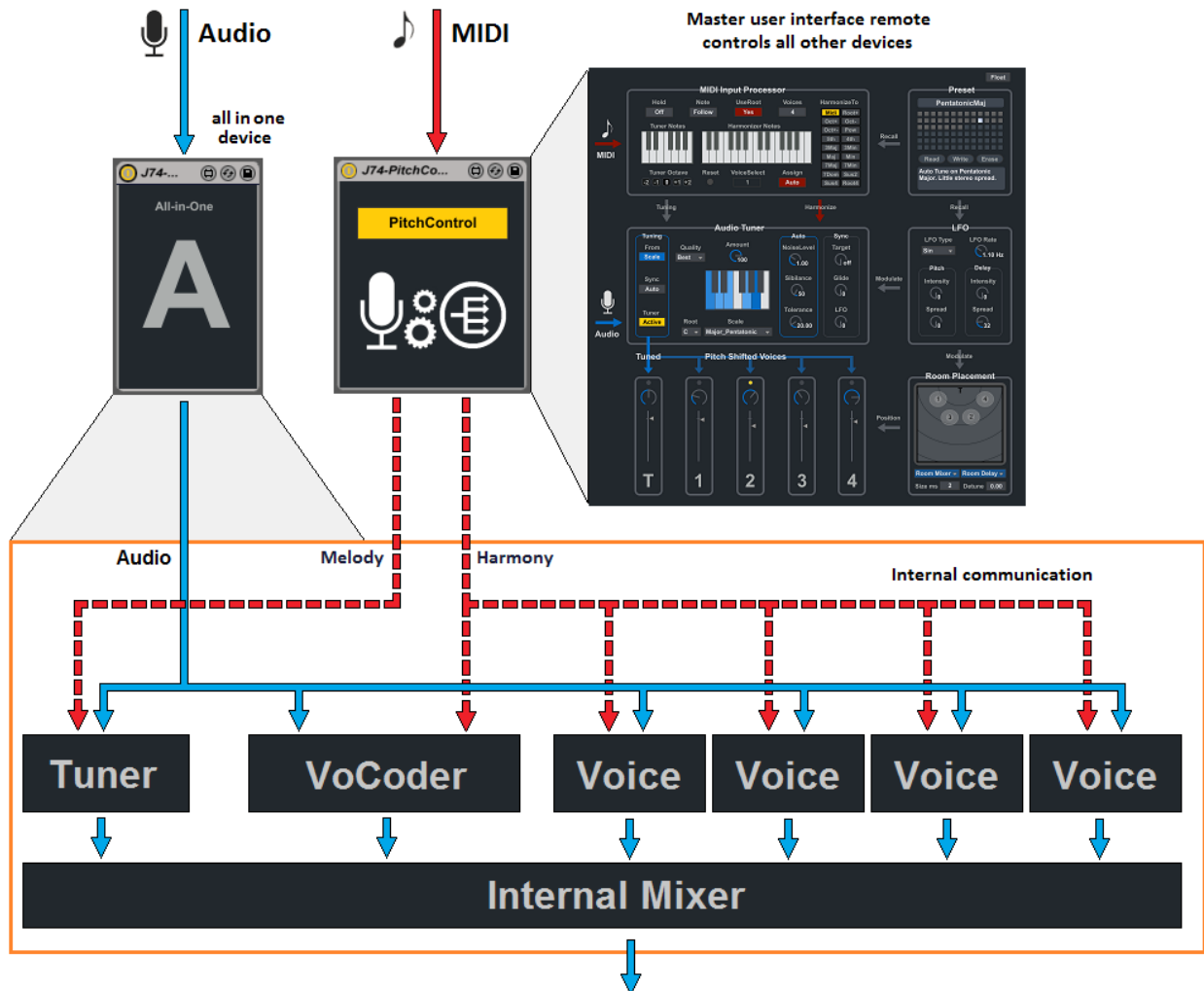
As you can see all you need is two devices. The Master receiving MIDI and the All-in-one (slave) audio device, which processes audio as instructed by the Master.

Next we will go through several other examples live-sets for various applications and processing chains. You can perform (most of) these applications in both modular configuration (individual slave devices, on separate tracks) or using the "all-in-one" slave audio device as described in this setup.

[Example / Template 1] MIDI Tuning in real time

Starting from this example we will look at specific applications. We will explain the setup using the individual devices for modularity and provide a note about applicability to the "all-in-one" case presented before.

Note: As we will see, modularity has its advantages (individual track mixing and processing, a few extra applications, cutting out unneeded processing stages and save CPU), while the generic disadvantage of having to deal with the extra I/O routing (which gets more complex).

The application for this example is actually straight forward: perform only Tuning, using MIDI input. Audio and MIDI can be both generated in real time or be pre-recorded. In this case no harmonization voice devices or vocoder will be added to the set, keeping things streamlined.

Below a picture showing the setup:

Relevant I/O routing:

- In the picture you can see that a dedicated audio track (Track nr. 1) is used for the source (with an external input from the audio interface, e.g. a microphone or pre-recorded audio clips).
- Track 3 in the picture holds the *Tuner device*. On this track set the [Audio From] to select the "Source" (track 1 output), as input. This in fact routes the input signal (microphone or clip) to the input of the Tuner.
- Also notice how the [Pre FX] option is selected on the Tuner's track input. This allows you to get the Source signal unprocessed (before any effect or mixer fader), so that you can apply processing and/or set the volume of the source track without affecting the signal fed to the Tuner's track. [Post FX] is also an option.
- The Tuner's track is finally set in [Monitor In] (orange) to allow audio to pass in.
- MIDI is sent *directly* to the Master device, as the only routing required. The Master device does its MIDI processing and sends note (pitch) information to the Tuner, without additional MIDI routing (it uses *internal messages* between devices). The [MIDI To] setting on the track is indeed irrelevant.
- On the Tuner device set either [Tuning Mode] to "MIDI" + [Sync] "Auto" or "MIDI" + [Sync] "ToMidi"

Tip: A dedicated track for the source signal is not mandatory (you could indeed simplify routing by having the audio fed directly to the Tuner's track) but recommended. This allows you to quickly switch to the original part for active/bypass reference, to blend processed and unprocessed audio together and to route the signal elsewhere.

As you would expect the audio source input (someone singing or speaking to a microphone, in real-time or a pre-recorded clip) will be re-pitched based on the MIDI notes played on track 2. If you wish, you can record the audio upfront and then apply MIDI tuning afterward, using a carefully planned MIDI clip.

Note: this application is possible also using the "all-in-one" slave audio device

[Example / Template 2] MIDI Tuning and MIDI Harmonization, at the same time (linked)
The goal in this case is to play J74 PitchControl in a way similar to playing a vocoder using both Tuning and Harmonization. It is worth noticing that in this setup we feed the harmonization voices with the output of the Tuner and therefore some "side effects" are present (some of which useful opportunities - such as gliding - while others possible issues to workaround). We will explain the latter, further into this section.

Set up a microphone and import (drag & drop) the template named accordingly. If you do not want to sing, you can use prerecorded clips instead. Below a visual summary of the I/O routing, with Audio in **blue** and MIDI in **red**.
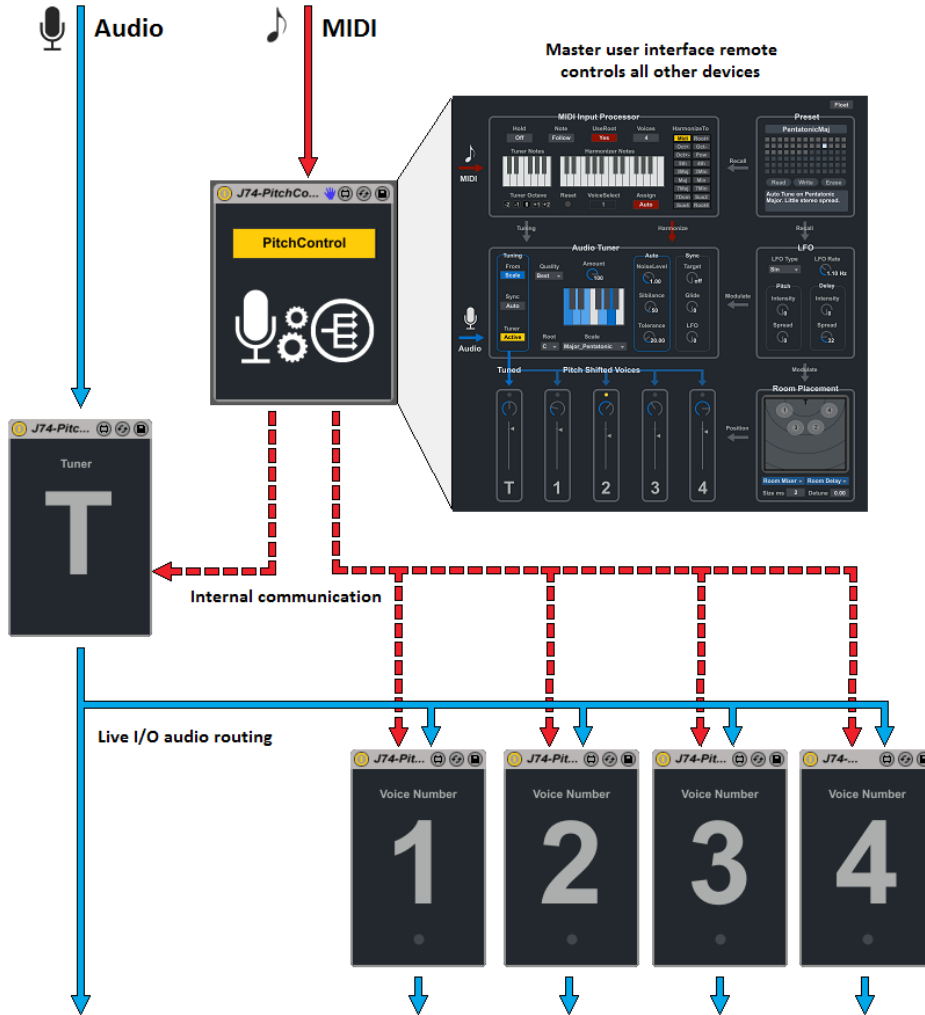
As you can see, this drawing conceptually recalls the previous one for the "all-in-one" (slave) audio device, with the fundamental change of having now the functionality being separated in individual slave audio devices (and tracks).

In this particular case, you can see from the picture that audio is sent to the Tuner unprocessed and that the Tuner feeds the four Voices directly with its output. This allows you to effect harmonization *from* tuning's pitch. Compared to the previous example (tuning only) the four harmonization Voices have been added. Consequently they need audio routing to be prepared for them.

Let's check now the routing required (on top of the previous case).

The first three tracks are identical to the previous case and so is the I/O routing applied to them. So, assuming you are now familiar with the setup of the previous case, we will proceed with looking at tracks 4 to 8.

In this application the output of the Tuner is sent to each Voice device, as input. This allows the Voice devices to work (harmonize) using the Tuner's output as input and do things such a glide changes, together with the Tuner.

- Each Voice devices goes in a dedicated audio track (tracks named Voice 1/2/3/4 in the picture above).
- On each track the [Audio From] routing selects "Tuned Voice" (track 3 output in this case), as input.
- Notice that in the routing the [Post FX] option is selected. This allows you to get the output of the Tuner device (eventually processed) *before* the mixer fader level, so that you can apply a different volume to the Tuner without affecting the level of the signal fed to the Voices.
- The Voice tracks are all set in [Monitor In] (orange) to allow audio to pass in.

Tip: It is also recommended, although not mandatory, to *group the Voice devices tracks together*. This is useful for mixing, as you may like to level, EQ and compress the harmonies as a single signal, to let the lead stand out.

Additional considerations:

- Make sure you can enter MIDI in real time, for instance using a keyboard or anything else sending MIDI.
- Make also sure the level of your microphone (or audio clip) is loud enough for the Tuner to work well.
- On the Tuner:
  - Set the [Tuning Mode] to either "MIDI" + [Sync] "Auto" or "MIDI" + [Sync] "ToMidi"
  - Set the volume of the Tuner track as liking. Put down the volume of the source (un-tuned) signal.
  - Play the Lead vocal tuned via MIDI in the Tuner-range (notes below C3) for the main melody.
- For Harmonization:
  - Set the [HarmonizeTo] to "MIDI"
  - Choose if to enable [UseRoot] for harmonization or not (allow or avoid duplicates of the lead)
  - Input MIDI notes for harmonized voices.
  - Experiment with MIDI velocity on the harmonization, as this maps to the volume of the selected voice.
  - Try adding [Glide] to the Tuner's part.

Tip: if the Glide option is activated, you can glide together both lead and harmonized voices, for an unusual effect. Set the value of [Glide] to about 120ms as a start (this often works well).

Side notes for the "linked" case:

This setup has one aspect you always need to keep in mind: the Tuner's output is sent to the Voices as input, so changes in tuning will affect the harmonization voices. This way:

- If any harmonized note is still being held at the time the Tuner changes pitch, the Tuner's new pitch will affect the pitch of the harmonization voices. These notes will be temporary moved in pitch of the same interval as the Tuner's pitch moved. This effect is momentary and stops once all the harmonized notes are released.

- If no harmonized voice is active, a new pitch is applied to Tuner will not affect new harmonization notes (new harmonization notes are re-tuned taking into account the Tuner change). Anyway the sound produced may present "timbre" changes (not the pitch, but the surrounding frequencies). That is: the harmonization voice still play a C if you press a C, but "that" C is influenced by the timbre of the Tuner's output after re-pitching. You can typically workaround this by moving harmonization notes up or down an octave.

- If you do not like the effects of Tuner pitch and timbre changes on the harmonization, you can feed the Voices with the source processed by the Static Tuner as described in the next example. *This will make MIDI Tuning and Harmonization independent from each other.*

Note: this application cannot be performed using the "all-in-one" slave audio device, due to its fixed architecture (which implies independent tuning vs harmonization).

Next we will look at an example which makes tuning and harmonization independent.

[Example / Template 3] MIDI Tuning and Harmonization, independent (use of the Static Tuner)
In the previous example, the Tuner's output is used as input signal for the voices. This way Tuner's changes of timbre (due to re-tuning) affect the timbre of the sound. If you want harmonization to be independent from tuning, you can modify the set and *add the Static Tuner utility to feed the Voices.*

The picture below displays how the routing would look like in this case.
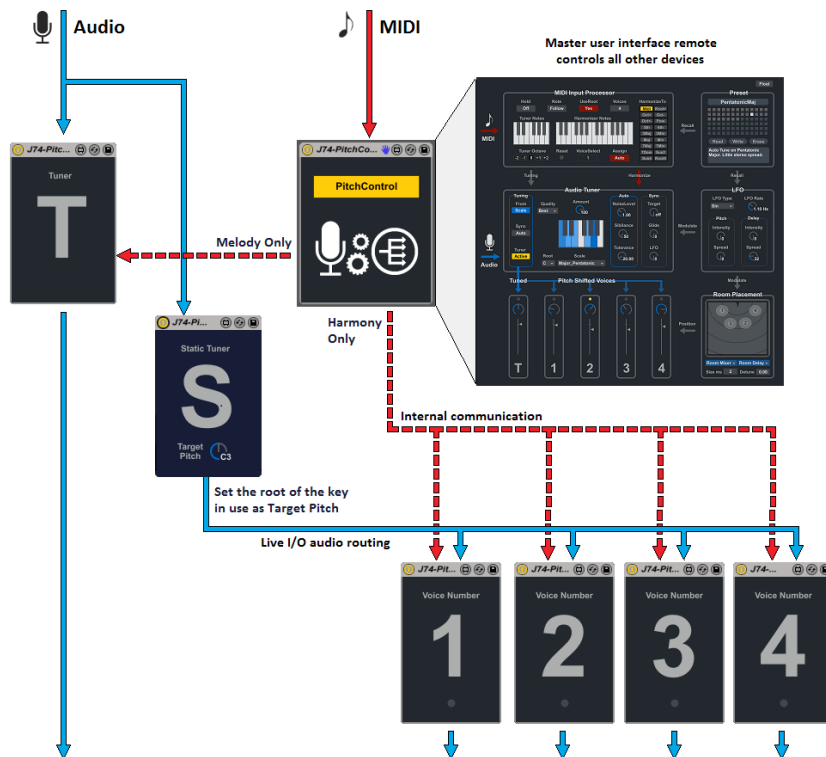
Next a picture showing the actual routing with the Static Tuner being added to the live-set (please open the example live-set so that you can check things out yourself).
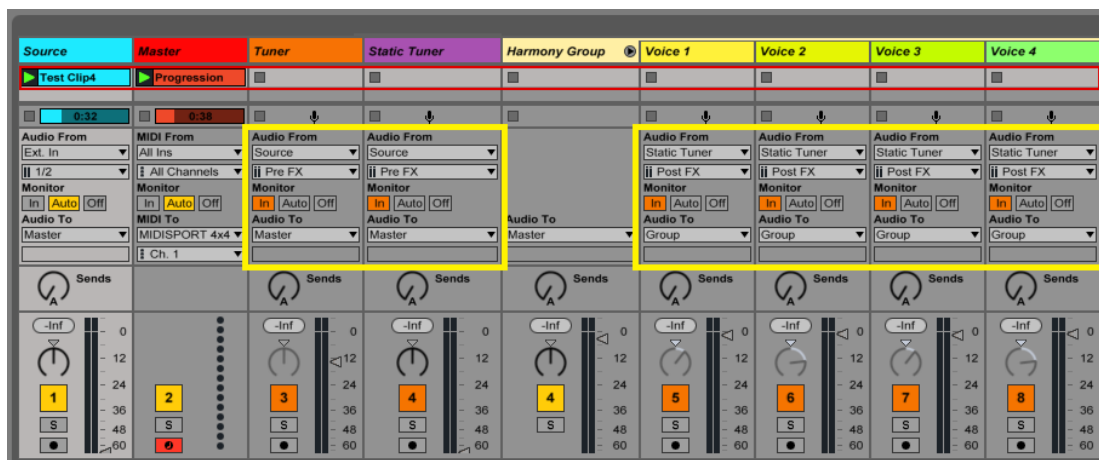
Relevant I/O routing:

- Create an additional track for the Static Tuner ("J74-PitchControl-StaticTuner.amxd").
- Select [Audio From] pointing to the original "Source" and use [Post FX] and [Monitor In] as other settings.
- On each Voice track, modify [Audio From] routing selecting the new "Static Tuner" track as input (keep the other routing settings to [Post FX] and [Monitor In]).
- On the Static Tuner's [Target Pitch] *select the key of the song*.
- You can bring the volume of the Static Tuner track to zero as we will not need to hear the reference pitch.

With this modification the pitch *fed to* the harmonized voices is always the same (the root pitch of the song or what you selected on the [Target Pitch] control of the Static Tuner) and therefore the notes you will create via MIDI harmonization always match the intended *absolute pitch*, independently from what the Tuner does.

Note: this application is possible also using the "all-in-one" slave audio device

[Example / Template 4] Using different Voice device flavors
Any of the previous cases involving harmonization can be modified by changing or mixing up the normal (black) Voice device and the alternative (red) Voice device. You could replace them all, or use one type of Voice device for voice 1 and voice 3 and the other type for voice 2 and voice 4 (or any other combination). This can result in a more organic harmonization, with different pitch-shifting algorithm working at the same.

Note: this application cannot be performed using the "all-in-one" slave audio device, due to its fixed architecture.

[Example / Template 5] Use of Room Placement and / or LFO for audio "effects"
You can make creative use of the Room Placement and LFO sections for reverberation, chorusing or delay effects. Here a few tips:

- If you like to have a relatively natural sounding effect, set the Tuner off (to "Bypass"). In alternative you can turn the Tuner on to use the LFO on its pitch.
- You can duplicate the ingress signal to one or more voices, by not shifting it. An option could be the use of the [HarmonizeTo] setting to "Root4" which creates four additional copies of the same signal (with no pitch shifting) so that you can be moved them around. In alternative set the [HarmonizeTo] to "MIDI" and set the [Note Follow/Trigger] to "Trigger", so that you can decide via MIDI how many copies of the input signal will be active at any given time.
- With Room Placement menu's in default settings, move the position of a voice around so that this moves the signal in the panning with a lower volume and introduces a delay given by the position. This can be a good way to create the illusion of a reverb.
- You can add de-tuning across the voices with the [Detune] option in the Room Placement, for chorusing.
- You can use the LFO section for other creative effects. For instance an LFO on the pitch of the four voices for a flanging effect. On the room delay, if [Intensity] > 5 and [Size] > 500) it will produce granular delays.

Below the user interface of the master devices with highlighted the relevant parameters:
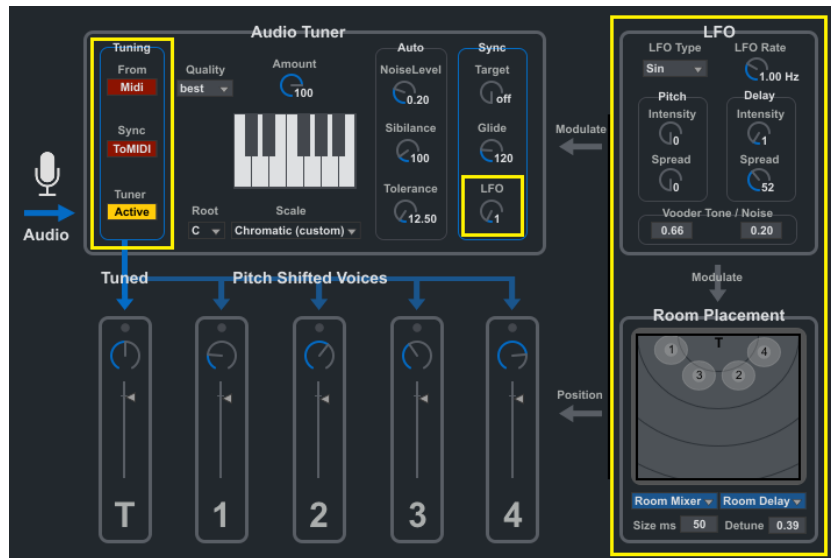
Note: this application is possible also using the "all-in-one" slave audio device.

[Example / Template 6] Vocoding with the VoCoder device
The VoCoder device is a vocoder and can be used for vo-coded harmonization. As explained in the LFO and FX section, set the VoCoder device goes on a dedicated audio track and gets the unprocessed audio source signal routed in. MIDI comes from the Master device in the harmonization range (C3 and above).

The *carrier* is based on an *internal synthesizer* while the source signal (microphone or clip) acts as *modulator*. You can use the VoCoder alone (with the Master) or in combination with any of the other devices as described in the other examples. Next a picture showing the setup with only the VoCoder (vocoding only).

Routing involved is quite simple in this case:

- Select as [Audio From] the "Source" (unprocessed signal).
- Set [Post FX] and [Monitor In].
- Have the Master device is in place with [HarmonizeTo] = MIDI.

Note: this application is possible also using the "all-in-one" slave audio device, although limited by fixed filter and octave settings.

[Example / Template 7] MIDI Tuning plus Vocoding
A simple addition to the previous case is to add the Tuner track to the example [1] setup. This way you can do MIDI tuning using the Master tuning MIDI range (below C3) and harmonization (by vocoding) using the Master harmonization MIDI range (below and equal C3).

Note: this application is possible also using the "all-in-one" device, although limited by fixed filter and octave.
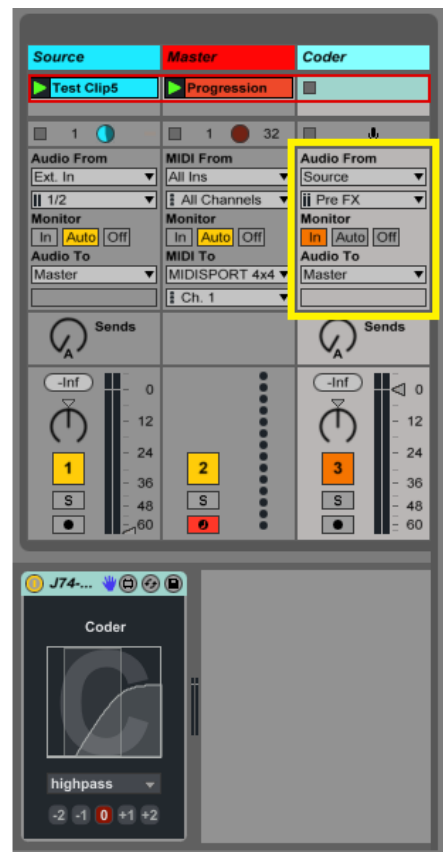
Next the case with all options enabled at the same time, which is essentially a super-set of this case (routing for the Tuner is identical).

[Example / Template 8] Tuning, Harmonization and Vocoding, all together
As a big *ensemble*, you can add all the three applications together by modifying the previous cases. As vocoding is done on absolute notes (not affected by tuning), the start point is the setup must be example [2] (with the Static Tuner in the set). On top of this we will add the VoCoder track, hosting the VoCoder device as in example [7] and [8].

The setup can be summarized by the following screen-shot:
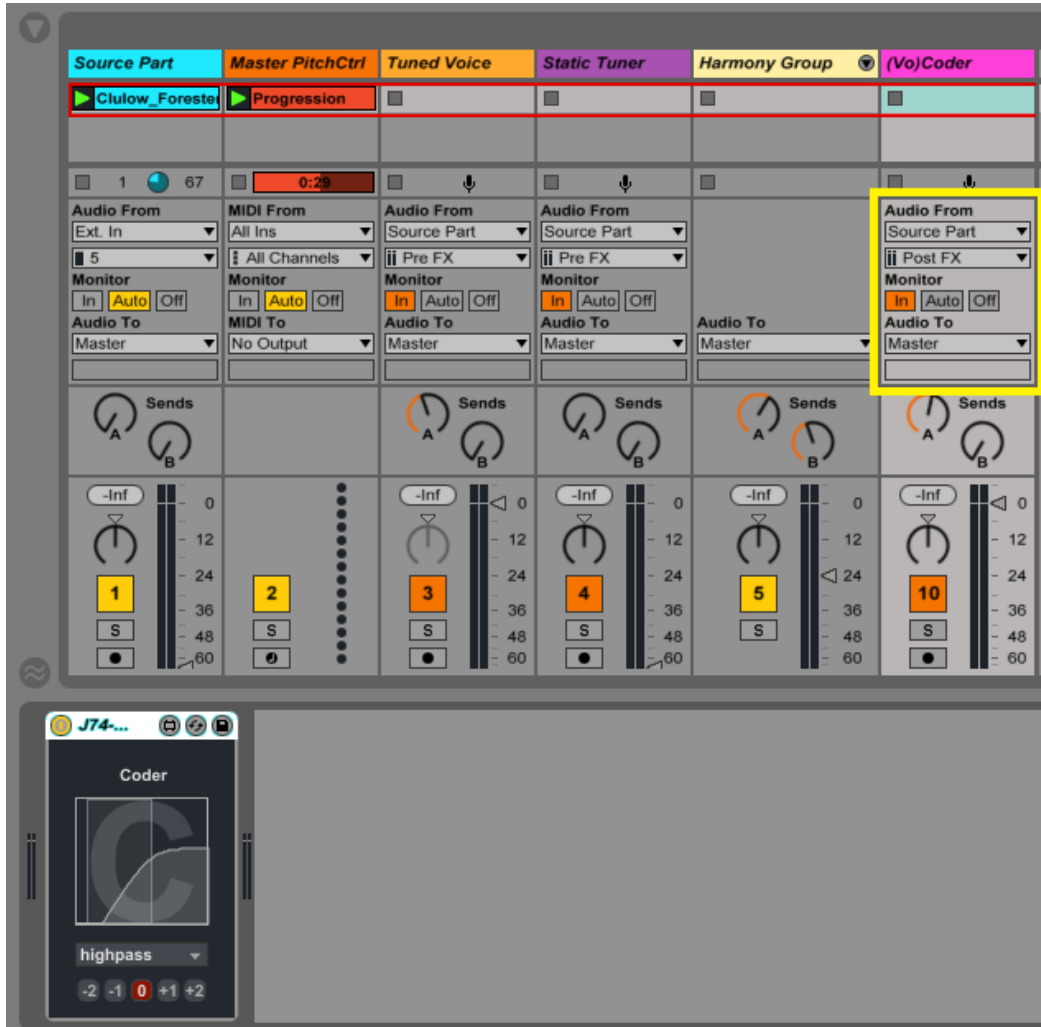
As you can verify yourself, compared to example [2], the only change is that the VoCoder track has been added.

Note: this application is possible also using the "all-in-one" device, which indeed essentially builds this configuration on a single audio device. The only limitations are the vocoder fixed filter and octave settings.

[Example / Template 9] MIDI Tuning and Harmonization, independent and "RePitched" (use of the Static Tuner)
This example is identical to example [3]. The only aspect to stress here is the fact that the Static Tuner's [Target Pitch] *selects the key of the song*. This is important as it is needed to shift the song's root pitch at the right key. Notes for the harmonizer section will automatically take this setting into consideration and be absolute.

Note: this application is possible also using the "all-in-one" device, which indeed essentially builds this configuration on a single audio device. The only limitations are the vocoder fixed filter and octave settings.

[Example / Template 10] Using the Mono versions of the audio devices
Besides audio recording, which we will look at further on, it is worth mentioning that an additional way to reduce CPU usage (of about a third) is to use the *mono versions* of the devices (Tuners and Voices). This is often an option as a signal recorded directly from a microphone is typically a mono signal (when unprocessed).

Any of the previous examples can be modified to have mono devices instead of stereo devices. Also worth mentioning is that you do not need to replace all devices with their mono versions. You can indeed mix-match any combination (they all behave the same). Use the [Reset] button on the Master device if you make device changes.

[Example / Template 11] Classic Auto tuning, done lightly
If your goal is simply to auto-tune a vocal "just a bit", you can use a setup similar to the one described in example [1] and change the [Tuning Mode] of the tuner to "Scale". Here the relevant configuration:

- Make sure the audio input has a signal level high enough for the Tuner's to work well
- Select [Tuning Mode] to "Scale"
- Select as scale the "Chomatic(custom)" as this will only tune notes of a relatively small amount.
- Set also the auto-tuning values to a gentle tuning, such as:
  - [Noise] at about 0,2
  - [Sibilance] at about 50-60
  - [Threshold] at about 25

Note: this application as well as all the next templates can also be performed using the "all-in-one" device.

[Example / Template 12] Classic Auto tuning, done the hard way
You can make auto-tuning go fast and aggressive for a T-Pain style effect if you wish. The setup is identical to the previous example while the key tuning parameter change:

- Make sure the audio input has a signal level high enough for the Tuner's to work well
- Select [Tuning Mode] to "Scale"
- Select a scale with a level of restriction in notes available. Such as a Minor or Major scale.
- Set also the auto-tuning values to aggressive tuning, such as:
  - [Noise] at 0
  - [Sibilance] at least 100 (or above)
  - [Threshold] at 0

[Example / Template 13] Auto tuning + Auto Harmonization (on relative intervals)
Your goal in this case is to auto-tune a vocal and add harmonization on top of it using fixed musical intervals, with no MIDI being played or sequenced. Here the relevant setup parameters:

- Tuner:
  - Activate the Tuner with [Tuning Mode] to "Scale"
  - Choose a [Root] and [Scale] which fit your content (see tips below).
  - Set the volume of the Tuner track to your liking and set the volume of the source (un-tuned) to 0.
- Harmonization:
  - If you want to have harmonization, set the [HarmonizeTo] to an interval of liking (see tips below)
  - If you wish control the volume of the harmonized voices to take harmonization in and out as you like.

Tips: Some intervals and scale combinations will work better than others, depending on the harmonic content in the source material. For instance:

- 4th, 5th, Power (root + 5th) and Sus2 harmony shapes fit normally well with diatonic scales. In this case the scale should be either Major, Minor, Dorian, Lydian, Mixolydian (Phrygian and Locrian may be a bit odd).
- The Minor and Major chord shapes may work well, if the "MajMin" scale is chosen (a scale limited to the root, fourth and fifth) in the appropriate root.
- A "jazzy feeling" can be achieved with the Min7 or Maj7 chord shapes, if the "MajMin" scale is chosen.
- You can also try the "Chromatic(scale)" and allow any note, ending up in pure "T-Pain" like harmonization.
- Or you can select the "Chromatic(scale)" and edit it to the notes which work best.

[Example / Template 14] Gentle Auto-tuning with FX
You can add effects to what is actually a tuning only application if you still use the harmonization voices in such a way they do not pitch-shift the signal. This is possible in two ways:

- An option can be the use of the [HarmonizeTo] setting to "Root4" which creates four additional copies of the same signal (with no pitch shifting) so that you can be moved them around.
- In alternative set the [HarmonizeTo] to "MIDI" and set the [Note Follow/Trigger] to "Trigger", so that you can decide via MIDI how many copies of the input signal will be active at any given time.

This way you can do (auto) tuning and use the voices for spacial effects.

[Variation] MIDI harmonization (on absolute notes), but no audible tuning
This approach is similar to example [2], but aims to a more natural vocal for the lead (we suppose here the lead was actually performed by someone who can actually sing in tune). We will still use the Tuner in this case, but in "background". Only the original lead (un-tuned) will be audible.

The harmonization notes will produce audible harmonization on absolute notes because based on Tuner's pitch, which we will set to the root key note of the song (if you play a E Major chord, the harmony will be a E Major chord independently from the vocal tone). Thes trick in this case are to use the same setup as in example [2] and (a) invert the volumes of Tuned and Source parts with now only the Source part is audible and the Tuner will have its volume to 0 and (b) have the Tuner work as a static tuner.

Use the following settings:

- Tuner:
    - Activate the Tuner with [Tuning Mode] to "MIDI" + [Sync] "Auto"
    - Set the volume of the Tuner track to 0. Raise the volume of the source (un-tuned) signal as liking. In this case the Tuner is not audible but still feeds the harmonization voices
    - Play the root note of the scale your song is into, for the Tuner MIDI range (or a MIDI clip which does the same). This is the only MIDI input for the Tuner.

- Harmonization:
    - Set the [HarmonizeTo] to "MIDI"
    - Choose if to enable [UseRoot] for harmonization or not (allow or avoid duplicates of the root)
    - Input MIDI notes for harmonized voices. Notes are absolute notes.

[**Tip**] **Get the input sound level right for the Tuner to work well**
In order to work correctly, the Tuner must get a relatively "hot" signal in ingress. If the signal is too low, it may cause the Tuner pitch detection to consider it as noise and leave it un-tuned. Therefore be sure to get a signal level loud enough for the Tuner to have it to work in its comfort area. Below a picture showing this (audio clip example):
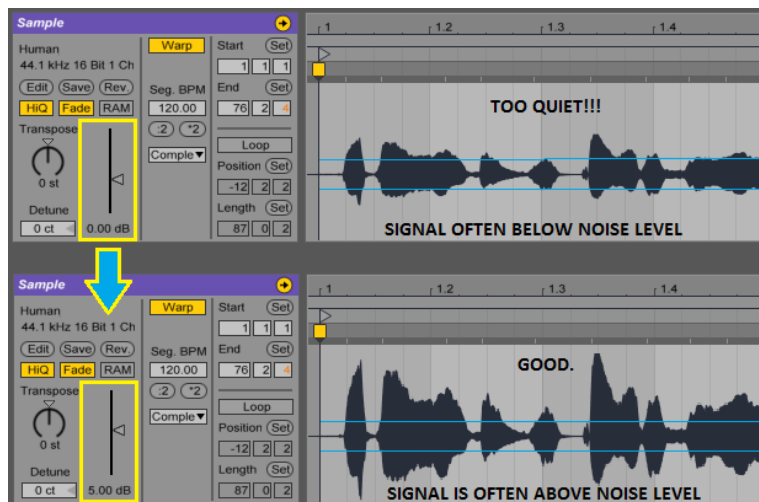
Note: In the case of a live input (a microphone) think about adding a compressor with make-up gain before the signal goes to the Tuner so that the audio signal works in the Tuner's comfort region. You can try to lower the [Noise] level of the Tuner as well, but normally compression plus input gain (in combination) is a better option.

[Tip] MIDI clips to sequence operations
MIDI in clips (for both arrangement and session views) can be used for both tuning and harmonization. This way you can sequence the part with more precision. Although all MIDI could be sent on a single track, by a single MIDI clip, a setup which splits MIDI upfront is more flexible (e.g. you can mix-up melodies and harmonies this way).

For instance:

- Use one MIDI track (Track 1 for instance) for the Tuner pitch. MIDI clips will be using notes below C3, in monophonic fashion to define the lead vocal melody.
- Use another MIDI track (Track 2 for instance) for the Harmonizer notes. MIDI clips in this case will be using notes above or equal to C3, in polyphonic fashion (up to 4) to define the vocal harmony.
- Dedicate a MIDI track to the Master (let's say track 3 in this example)
- Set Ableton Live I/O routing for MIDI so that both Tuner and Harmonizer send MIDI to the PitchControl Master track. This can be done by setting the [MIDI To] for both Track 1 and Track 2 to "Track 3" (or the name you have selected to the Master track). Finally set the Master track [Monitor] to "In" orange.

You can now sequence both tuning and harmonization via independent MIDI clips. If you wish you can choose an audio configuration similar to the previous case if you only to hear harmonization (the Tuner pitch will then be set to the root of the selected scale and volume of the Tuner track set to 0) or instead the configuration of the first case described if you like to tune the lead vocal as well.

If you wish you override automatic voice selection and sequence the voice selection for each individual note of the harmony. To do this set the [Voice Assignment] to "Manual" mode and prepare a clip envelope for the [VoiceSelect] parameter, defining which voice will sing the next harmonized note. If you are happy with the automatic selection for the harmony, leave [Voice Assignment] to "Auto".

About the Manual [Voice Assignment] timing: if you are doing manual assignment be sure that the clip automation for the [VoiceSelect] gets the "space" to select the next voice. This means: you cannot have multiple notes set to start at the *exact* same spot, because [VoiceSelect] can only prepare one voice at the time. So move note start times from each other, just enough to have the room for [VoiceSelect] to define the right voice for the next note.

[**Tip] reducing CPU Usage**
All this real-time re-pitching and pitch-shifting costs CPU resources. The best approach to reduce the CPU usage is
to get rid of the real-time processing once the result needs to be repeated. This actually translates into *recording
the results as audio*, as soon as you are satisfied with them. To do this you can use additional audio tracks, where
you route audio output from the Tuner and Voice devices, using Ableton Live audio I/O routing features.

Next a picture showing how to do that:

Notice the audio routing outlined with yellow boxes and an audio clip recording the results as audio.

Note: Once your recording has been completed, you do not have to delete the J74 PitchControl devices (Tuners and
Voices) from the project: it is sufficient to *disable* them to get rid of the high CPU usage. So you can still go back
anytime and change the performance by re-enabling them and working as usual (recording to another audio clip).

Note: besides audio recording, it is worth mentioning that an additional way to reduce CPU usage (of about a third)
is to use the *mono versions* of the devices (Tuners and Voices). This is often an option as a signal recorded directly
from a microphone is typically a mono signal (when unprocessed). Note that this is not possible using the "all-in-
one" slave audio device.

Issues and Questions
May you encounter issues, please contact me via email at: info [at] fabriziopoce.com