Blue Jeans and Moonbeams 4

v.4.23.04 ©2018-23 by Malaclypse the Younger, **mal2fnord@gmail.com**

Blue Jeans and Moonbeams (or BJAM for short) is a sampled S-Type (Strat) electric guitar designed for those familiar with the playing and signal processing techniques used with actual electric guitars.

Getting Started:
- Load up your favorite SFZ handling plugin or software. Sforzando 1.969 is targeted, tested, and known to work, but others probably do as well. Load the SFZ script into it.
- CPU Overload? Try the Fast and Bulbous versions with the Tone Stack disabled.
- If you wanted Maize Sampler, BJAM 2 is still available if desired.
- OCTAVE NOTATION: All references to pitch names such as C3 use the convention that C3 = key 60 ("the Yamaha way") like most DAWs and plugins. The script itself uses only note *numbers* specifically to sidestep any incompatibilities.

Preparing BJAM Guitar or Ella Gitauru:
Select a keyswitch from the bottom octave of the keyboard. Default is **D-2 (key 2)**.
- **C-2 (key 0): Open Position** is the cowboy chord zone, and uses as many open strings as possible. The Slap & Pop and Mute modes are also set up this way.
- **C#-2 (1): Fifth Position** moves the fret hand to frets 5 to 8 any time it is possible to play a given note there, otherwise sliding up or down the appropriate E string.
- **D-2 (2): Solo Mode** traverses the neck on a slant, using one string for seven semitones until the high E is reached, blending smoothly from Open Position to Up Neck.
- **D#-2 (3): Hammer-Pulloff-Slide** mode produces notes without an attack envelope, allowing for all manner of unplucked note changes. This uses the string assignments of Solo Mode. You can also jump directly into this mode with the Sostenuto pedal (CC66). Ddetails such as hammering hard or gently should be accommodated with judicious selection of note velocity.
- **E-2 (4): Up Neck** moves the fret hand to frets 11 to 14 any time it is possible to play a given note there, otherwise sliding up or down the appropriate E string.
- **F-2, G-2, A-2, B-2 (keys 5, 7, 9, 11): Harmonics 2, 3, 5, 7.** All harmonics are based on the same samples, but tuned to the harmonic series. Prime-numbered harmonics were selected as most versatile. The higher the harmonic, the more gently it starts.
- **F#-2, G#-2 (keys 6, 8): Mute** produces palm muted notes which are also reasonable facsimiles of sweep picked notes. There are two types of muting, Long (F#) and Short (G#). Long mostly mellows the tone without removing all sustain, while Short is more of a metal chug. You can soften the effect via CC71.
- **A#-2 (10): Slap & Pop** mode is exactly what it says on the tin. Also useful for chicken pickin'. Also softens with CC71.

Select your pickup(s) or 6-string/12-string levels with MIDI CC16 to CC19. BJAM uses them to control the volume of the bridge pickup, the middle pickup, an inverted middle pickup, and the neck pickup, in that order. For Ella G, you only need CC16 and CC17, which control the "normal" 6 string side and the "Nashville" side respectively. Mixed together, you get a 12-string, and they don't have to be mixed at the same level – CC16 at 50% and CC17 at 100% sounds nice and sparkly, for example. Default for both instruments is to start with CC16 all the way up, and everything else at zero, which means Bridge pickup only for BJAM and 6-string only for Ella G.

At this point, BJAM needs DAW inserts to form a **signal chain**. The following is a pretty common order, although many steps will be skipped in any given setup. Often all you need is an amplifier and a cabinet, which might even be one unit.

1. Wah or Auto-Wah
2. Fuzz
3. Compressor (multi-band recommended)
4. A mixture of Boost, Overdrive, and/or Distortion.
5. Amplifier (may include cabinet emulation)
6. Equalizer
7. Modulation (Chorus, Flanger, Phaser, Tremolo, etc.)
8. Delay
9. Reverb
10. Cabinet, if not included in Amplifier stage. Placing it here more closely resembles using the Effects loop on an amplifier that is so equipped.

Playing BJAM 4:

BJAM is admittedly targeted at perfectionists and micro-managers, although you can "sloppy up" a take without too much effort expended. Certain noises and performance modes are provided for enhancing the realism of your performances:

- Chuck noises are made by muting all strings with the fretting hand, then strumming. They are separated into "Down Chucks" and "Up Chucks" depending on which way they were strummed, if I can even tell.
  - o **C-1 (12)** and **D-1 (14)** are **Down Chucks** and **Up Chucks** respectively.
- Swipe noises result from fingertips (or a barre) being dragged up and down the neck. These are separated into "long" and "short" swipes, but both categories have some in-between examples.
  - o **C#-1 (13)** and **D#-1 (15)** are **Long Swipe** and **Short Swipe** respectively.
- **CC1** (Modulation) creates a vibrato effect that swings both sides of the central pitch by up to 120 cents.
- **CC3** controls **Modulation Rate**. Range is 3 Hz to 8 Hz, default at 50% (5.5 Hz).
- **CC4** controls **modulation delay**, up to 10 seconds. Default is 0, it reacts instantly.
- **CC7** is Master Volume. Default is 80/127.
- **CC10** adjusts the pitch of all pick noises (auto or manual) up to ±2 semitones, as would happen when moving the picking location away from or toward the bridge.
- **CC14** controls **Autopicking**. This will insert a pick scrape appropriate to the note being played at the beginning of every note, and the volume will depend solely on the value of CC14 (it ignores note velocity). A delay of up to 50 ms is also added to the note start, and also depends on the value of CC14. Combine Autopicking with soft playing for a "crying guitar" effect.
- You can also make pick and swipe sounds directly, using octave -1. **E-1 to A#-1 (keys 16 to 22)** are the various pick noises. There is a "7th string" pick because the 6th sounds odd when applied to really low notes.
- **CC28** controls the mixture of **Reactive Tone Modeling**. This models how guitar strings get darker as they get shorter. Set at 0 this will do nothing, matching the behavior of BJAM 3 and prior. Default is 89 (70%).

- **CC31** controls **Dive Bomb**. This emulates using the whammy bar on the sampled guitar – each string has its own depth of bend. (See Appendix 1.) Deflection is modeled based on the sampled instrument, and a floating bridge is emulated. Default is 83%, so you can pull the pitch in either direction, but much further down than up. **Note:** If you want *even* bends such as you might get with a Virtual Jeff or a Whammy pedal, use the regular pitch bend instead.
- **CC36** to **CC47** handle the tuning of individual pitch classes across all octaves. This can be used for temperament, or to bend individual notes separately, among other purposes. Default is 50% (neutral), with a range ±2 semitones.
- **CC48** to **CC59** allow mixing of individual pitch classes across all octaves, ±12 dB. Default is 50% (neutral). The CC assignments match CC36-47 with another 12 added.
- **CC66** is the Sostenuto pedal, here used as an alternate way to engage Hammer-Pulloff-Slide mode. This will do nothing if you are in one of the Harmonics keyswitches.
- **CC67** is the Soft pedal, used in BJAM to enable left hand muting. (Overridden by H-P-S mode and Harmonics keyswitches.) Not used in Ella G.
- **CC71** is **Spank** (formerly called Mute Mix, but what it does to the Mute settings hasn't changed). If you want to soften the "plink" and/or "chug" of muted and popped notes, pull this value down from the default of 100%. The same parameter affects Long Mute (F#-2), Short Mute (G#-2), and Slap/Pop (A#-2). You will hear the most effect in the mutes at the high end of the scale (70-100%), but the most effect in Slap & Pop occurs at the lower end (0-30%).
- **CC72** is **Fundamental**. This adds the "chug" sample for the note played to all harmonics. Default is 0% (off).
- **CC73** controls **Attack Time**. If you want to roll in every note, this will do it. The range is 0 to 1 second, with a default of 0. This will *not* cause already sounding notes to fade or swell.

The actual sounding range is from **B-1 (23)** (same as the bottom of a 5-string bass) for BJAM, or **C0 (24)** for Ella G, to as high as SFZ wants to support with the given samples. Notes below E1 extrapolate the string 6E samples (except where "7B" string samples exist), and notes above D4 extrapolate the high E string using mf samples only. Pitch bend range is ±2 semitones for backward compatibility, but this can be altered in your SFZ handler (Sforzando has an easily accessible setting for this) or in the script itself.
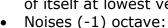
There are four velocity layers using three samples per note: 111-127 is ff and played as hard as I could without getting fret buzz. These notes often start substantially sharp and glide down to pitch, as recorded (not modeled). 81-110 is f and may still have a minimal amount of pitch glide. 1-80 uses the mf sample, but crossfades in more of a fade-in (up to 100 ms) as you play softer.

About BJAM 4:

- All samples were taken by me from the pictured guitar (which I built myself), and all three pickups were recorded simultaneously for proper mixing.
- The floating bridge was blocked during sampling for maximum sustain.
- The pickups are generic "Hot Rails" style humbuckers, with ceramic magnets. Background noise was further reduced "in post".
- Sampling was reduced to 22k and saved as OGG (quality 10/10) at the last stage to keep file sizes reasonable, as guitar cabs shouldn't be reproducing anything over 10k.
- If you want behavior that matches BJAM 3, set CC28 (Reactive Tone Modeling) to 0 because that is a new feature in BJAM 4 and *will* change the sound of your renders.

About Ella Gitauru 4:

- Sampled (by me) from a Fender DG8S dreadnought acoustic guitar. Strings are Elixir Nanoweb 80/20 bronze, 12-53.
- The keyswitches (-2 octave, 0-11) function the same as BJAM 3, shown above.
- Five velocity layers. 120-127=ff, 92-119=f, 49-91=mf, 0-48=mp crossfading to a faded-in version of itself at lowest velocities.
- Noises (-1) octave:
  - **C-1 (12):** Chuck
  - **C#-1 (13):** Swipe
  - **D-1 (14):** Thump (striking the top plate with the side of a fist)
  - **D#-1 (15):** Slap (striking the top plate with an open hand)
  - **E-1 (16):** Knock (striking the top plate with knuckles)
  - **F-1 (17):** Tap (striking the scratch guard with a fingertip, nail first)
  - **F#-1 to B-1 (18 to 23)** correspond to pick noises, from low 6E to high 1E.
- The following MIDI CCs operate the same as they do in BJAM above: **CC1**, **CC3**, **CC7**, **CC10**, **CC14**, **CC20** to **CC28, CC35** to **CC73**. Differences are detailed below.
- **CC16** corresponds to the normal 6-string side, and **CC17** corresponds to "Nashville". **CC18** is an *inverted* version of "Nashville" for a pokier sound when combined with the 6-string.
- **CC19** is 12-String Detune. The "Nashville" tuned side is 4 cents sharp by default so that it will jangle a little against the normal 6 string side when used as a 12-string. Available range is ±10 cents, and 50% means no detune.
- **CC31** is called "Neck Dive" and acts similarly to BJAM's "Dive Bomb", just smaller. The deflection is chosen by ear, not to match a physical model (I didn't want to break a borrowed guitar).
- **No signal chain is required.** You can, of course, use effects with an acoustic guitar. EQ, delay, reverb, and phase effects are all very common. You don't have to, though. Starting with Version 4, I have baked extra treble into the samples, more or less offset by the extra darkness from **Reactive Tone Modeling (CC28)**.

About the Developer:

Mal-2 (**mal2fnord@gmail.com**) is a freelance musician (hired gun) who was dissatisfied with the realism and versatility of existing free guitar VSTs. You have the result in your hands. If you have a guitar you would like sampled and turned into a virtual instrument, contact me. My preference would be to borrow it, but perhaps I can get you to provide the necessary samples.

A fair number of demos are included with the BJAM 4 package in both audio and MIDI forms, but they (and possibly more) are also available at https://mal-2.bandcamp.com/album/bjam-demos. Source is included, and you are encouraged to inspect and tweak it. (Note: If you intend to redistribute your changes, the MIT License requires that you mark them as yours so people don't ask *me* what *you* were doing.)

If this is all too much for you, Mal-2 is available for hire – drop a line to the address above. This could be for the entire project, or just for the guitar part(s), or anything in between.

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Appendix 1 – Technical Details and Specs:

Keyswitches. These are the same for both **BJAM** and **Ella G**.
- C-2 (key 0)   Open Position (uses open strings and frets 1-4 when possible)
- C#-2 (1)   Fifth Position (uses frets 5-8 when possible)
- D-2 (2)   Solo Mode (7 semitones per string, diagonally up the neck)
- D#-2 (3)   Hammer-on/Pull-off/Slide mode (uses Solo Mode assignments)
- E-2 (4)   Up Neck Position (uses frets 11-14 when possible)
- F-2 (5)   Harmonic 2 (octave)
- F#-2 (6)   Mute Long (uses Open Position assignments)
- G-2 (7)   Harmonic 3 (octave + 701.6¢)
- G#-2 (8)   Mute Short (uses Open Position assignments)
- A-2 (9)   Harmonic 5 (2 octaves + 386¢)
- A#-2 (10)   Slap & Pop Mode (uses Open Position assignments)
- B-2 (11)   Harmonic 7 (2 octaves + 959¢)

Noises. These differ between instruments, beyond the first two items.

BJAM Only:
- C-1 (12)   Down Chucks   ◄ === ►
- C#-1 (13)   Long Swipes   ◄ === ►
- D-1 (14)   Up Chucks
- D#-1 (15)   Short Swipes
- E-1 (16)   Pick 7B noise
- F-1 (17)   Pick 6E noise
- F#-1 (18)   Pick 5A noise
- G-1 (19)   Pick 4D noise
- G#-1 (20)   Pick 3G noise
- A-1 (21)   Pick 2B noise
- A#-1 (22)   Pick 1E noise
- B-1 (23)   *Normal note, not a noise*

Ella G Only:
- C-1 (12)   Chuck noise
- C#-1 (13)   Swipe noise
- D-1 (14)   Thump (side of fist)
- D#-1 (15)   Slap (open hand)
- E-1 (16)   Knock (knuckles)
- F-1 (17)   Tap (fingertip/nail)
- F#-1 (18)   Pick 6E noise
- G-1 (19)   Pick 5A noise
- G#-1 (20)   Pick 4D noise
- A-1 (21)   Pick 3G noise
- A#-1 (22)   Pick 2B noise
- B-1 (23)   Pick 1E noise

When porting sequences composed for another instrument, *move* the notes into the correct octave if they're not already there. I do not recommend using a MIDI Modifier to shift them because keyswitches and the MIDI Modifier method do not play nice together. At all.

Note-to-String Assignments

The four fretting positions function the same in both instruments. Aside from harmonics, which are based on the note being turned into a harmonic, octaves match actual sounding pitch, not written guitar pitch. The first "real" note is E1, everything below that is considered "extended range", which uses 6E string samples (except for pick noises and left hand mutes, which do have a "7th string"). Red text indicates the breakpoint for octave/unison on the "Nashville" side of Ella G.

- **C–2 (0): Open Position[1].** Every note is played with as long a string as possible, using open strings freely. "Cowboy Chords" mode.
  6E: C0 to G#1
  5A: A1 to C#2
  4D: D2 to F#2
  3G: G2 to A#2 (58) Octave
  2B: B2 to D#3   Unison
  1E: E3 and up.

- **C#–2 (1): Fifth Position.** Every note that can be played in frets 5 to 8, is. All notes outside this range are played on the relevant E string.
  6E: C0 to C#2
  5A: D2 to F#2
  4D: G2 to B2
  3G: C3 to D#3 (63) Octave
  2B: E3 to G#3   Unison
  1E: A3 and up.

- **D–2 (2): Solo Mode[2].** Every string is used for 7 semitones before moving on, starting from low E.
  6E: C0 to A#1
  5A: B1 to F2
  4D: F#2 to C3
  3G: C#3 to G3 (67) Octave
  2B: G#3 to D4   Unison
  1E: D#4 and up.

- **E–2 (4): Up Neck.** Every note that can be played in frets 11 to 14, is. All notes outside this range are played on the relevant E string.
  6E: C0 to G2
  5A: G#2 to C3
  4D: C#3 to F3
  3G: F#3 to A3 (69) Octave
  2B: A#3 to D4   Unison
  1E: D#4 and up.

Notes:

° **Nashville tuning** is the practice of setting up a 6-string guitar with only the doubling strings of a 12-string guitar. In addition to mixing with a 6-string, it can be used alone to provide strummed chords that don't clutter up the low mids. Sometimes the "6E" string is even raised *another* octave to match the high E when used for this purpose (but I'm not doing that here, it would interfere with 12-string functions).

[1] Harmonics, Slap & Pop, and both Mute keyswitches also use these assignments.

[2] Hammer-on/Pull-off/Slide mode as implemented with keyswitch D#-2 (key 3) shares Solo Mode (D-2) string/fret mapping. However, the Sostenuto (middle) pedal, CC66, will implement a Hammer/Pull/Slide mode with a mapping that matches whatever mode you would be in if not pressing the pedal (except harmonics). You can change positions with the pedal still down.

MIDI CC assignments, ranges, and defaults. Most can be set by changing variables in the **#define** range at the top of the SFZ script, if you wish a different default or range. The default % value appears in the name of the CC itself, e.g. **1:Mod Depth 0**.

- **CC1:** Modulation Depth. 0 to 120 cents, default of 0 (0%).
- **CC3:** Modulation Rate. 3 to 8 Hz, default is 5.5 Hz (50%). This takes effect immediately for all notes, including those already sounding, so it can be used for expression within a note.
- **CC4:** Modulation Delay. 0 to 10 seconds, default of 0 (0%).
- **CC7:** Master Volume. The bog standard range and (concave) curve are used. Default is 80/127, or 63%. This is exactly equivalent to the volume knob on the guitar.
If you are passing signal through any sort of compression or distortion phase, turning the volume up and down here will change your tone more/rather than your final output level, as the volume changes are compressed away by the gain stages.
- **CC10:** Pick Pitch. This shifts all pick noises (whether manually or automatically triggered) in pitch by ±2 semitones, and also any left hand mutes ("ghost notes"). The default is 50%, which is no shift. This "recycles" and disables the Pan control.
- **CC14:** Autopicking. The volume of Autopicking is directly controlled by the value of CC14 and is not affected by note velocity. CC14 also determines the amount of delay before each note to make space for the pick rub (up to 50 ms). Default is 0.
- **CC16:** Signal 1 level. For BJAM this is the Bridge pickup, while for Ella G it is the primary 6-string output. All of the pickup sliders are linear by design, to allow more subtle mixing of multiple pickups. Default is 100% so that there will always be something enabled at startup.
- **CC17:** Signal 2 level. Default is 0. For BJAM this is the Middle pickup, while for Ella G it is the "Nashville" side (6E, 5A, 4D, and 3G strings are all raised by an octave each).
- **CC18:** Signal 3 level. Default is 0. For BJAM this is the Middle pickup with the phase inverted, but only if CC17 is set to 0. For Ella G, this is reserved for a planned feature.
- **CC19:** This differs between the two instruments, as follows:
  - **BJAM:** Signal 4 level, Neck pickup. Default is 0 (off).
  - **Ella G:** 12-String Detune. This controls *only* the "Nashville" side of the instrument, to let you dial in the amount of shimmer or jangle you get when combining both signals to emulate a 12-String instrument. The range is ±10 cents, and 50% represents no detune (which is really bland). The default is 70% (+4 cents). Every increment of 5% is one cent of pitch change.
- **CC28:** Mix control for Reactive Tone Modeling, which uses the length of vibrating string to determine how much to tone down each note, based on where the fret hand is located and what string is in use.
- **CC31:** Dive Bomb or Neck Dive. This bends all strings with the whammy bar or by abusing the neck. Default is 106 of 127 (83%), and "neutral" being this far up the scale means maximum upward bend is only 20% of the maximum downward bend.
BJAM – Dive Bomb. Maximum bend by string is based on the sampled instrument:
  - 6E: -12 semitones (octave)
  - 5A: -6.4 semitones
  - 4D: -5.8 semitones
  - 3G: -9.7 semitones
  - 2B: -5 semitones
  - 1E: -3 semitones
Ella G – Neck Dive. This is a reduced version of Dive Bomb, as the instrument is not fitted with a floating bridge. Instead this emulates leaning on the neck, twisting the neck, and/or shaking the entire instrument while playing. Maximum bend is based on an educated guess (this is *not* good for the long-term health of a wooden instrument, but .) Neutral is 106/127 (83%).

- o 6E: -2 semitones
- o 5A: -1.4 semitones
- o 4D: -1.25 semitones
- o 3G: -1.5 semitones
- o 2B: -1 semitone
- o 1E: -0.75 semitones

- **CC36** to **CC47:** Tune individual pitch classes. To make things slightly easier to remember, each CC is associated with the same key number in the C1-B1 octave, while the effects span all octaves. CC36 controls all "C" notes (24, **36**, 48, 60, 72, 84, 96, 108, 120), CC37 controls all "C#" notes (25, **37**, 49, 61, 73...), CC38 controls all "D" notes (26, **38**, 50, 62, 74...), and so on up to CC47, which controls all "B" notes (35, **47**, 59, 71, 83...).
- **CC48** to **CC59:** Mix individual pitch classes, ±12dB. The assignment of CC to note is similar to CC36-47, except 12 spots higher. This can be useful for adding energy to a particular note already sounding, although the other effects of the energy input (such as vibrato) are left to you to perform.
- **CC60, 61(, 62):** Delay on a per-source basis. For BJAM, this simulates the phase delay in the pulses hitting various pickups. For Ella G, this emulates the two strings of a 12-string course being played slightly asynchronously.
- **CC66:** Sostenuto pedal. When depressed (high values), this engages Hammer-Pulloff-Slide mode for all keyswitches except Harmonics. Such modes use the same string/fret layout as the same keyswitch without the pedal. **NOTE:** Using the D#-2 keyswitch invokes Solo mode for its layout, because it can't remember where you came from. If you need the legato to tone-match better, you have to use the middle pedal.
- **CC67:** Soft pedal. In BJAM this engages left hand muting unless you are in H-P-S mode or one of the Harmonics. Not enabled in Ella G.
- **CC71:** Spank. (Formerly called Mute Mix, the job hasn't changed.) This causes the Long Mute (F#-2) keyswitch to mix with Open Position samples that have a 150 ms attack added, causes the Short Mute (G#-2) keyswitch to mix with Long Mute samples, and mixes Open Position with Slap & Pop. Default is 100%, which produces the shorter/spankier samples exclusively.
- **CC72:** Fundamental. This adds "chug" samples of the base note to all harmonics, to emulate a harmonic that allows some of the full-string note to ring through. This defaults to 0 (off) and is surprisingly effective at single-digit values. Pushed all the way up, the "chug" sample will completely replace the harmonic.
- **CC73:** Attack Time. This controls how fast notes fade in. The range is from 0 to 1 second, and the default is 0. Note that this is independent of any Delay imposed by Autopick mode (first there is a Delay, then an Attack time), and in addition to any attack time added for low velocity notes.

Pedal CCs (64, 66, 67) are either "off" (value below 50%) or "on" (value above 50%). All the SFZ handler is looking at is the Most Significant Bit, which is either 0 or 1.

> You can set any MIDI CC from the Controls tab in Sforzando itself, but the change will be lost if the MIDI track specifies a value for that CC, or if you change out the SFZ. Similar things can happen if you use the onscreen keyboard for keyswitches. Embedding the change in the MIDI is the robust solution, once you know the value/keyswitch you want.

Pitch Bend
Pitch Bend in Maize Sampler was hard locked to ±2 semitones, so that remains the default setting in BJAM 3. However, you should be able to override this in your SFZ handler. Personally I go straight to ±12 when I need more, because I remember where the semitones are (±683, ±1365, ±2048…) and because that's where DSK likes to put their default pitch bend.

Pitch Bend stacks with the various tuning features on CC10, CC19, CC31, and CC35 to CC47.

Velocity Assignments
This is where the two instruments are most different. Velocity 0 is always an alias for "note off", that's part of the MIDI standard.

BJAM uses three samples: mf, f, and ff.
- Velocities 1 to 80 use the same mf sample, but the closer you get to 1, the more it shifts balance toward a version that takes 100 ms to fade in.
- Velocities 81 to 110 use the f sample, which has a bit of a pitch glide (starts sharp and settles down).
- Velocities 111 to 127 use the ff sample, which has a noticeable pitch glide (as recorded).
- Due to pitch glide, there is no crossfading between the three samples.

Ella G uses four samples, mp, mf, f, and ff.
- Velocities 1 to 48 use the mp sample, which shifts toward a faded-in version as you approach velocity 1 (very similar to 1-80 behavior in BJAM).
- Velocities 49 to 91 use the mf sample.
- Velocities 92 to 119 use the f sample.
- Velocities 120 to 127 use the ff sample.
- As with BJAM, the f and ff samples have pitch glide baked in (as recorded) and do not crossfade with one another.

Harmonics
All harmonics are tuned closely to their actual pitches in the Harmonic Series.
- Harmonic 2: Exactly one octave up (2:1).
- Harmonic 3: Octave, plus 701.6 cents (3:1).
- Harmonic 5: Double octave, plus 386 cents (5:1).
- Harmonic 7: Double octave, plus 959 cents (7:1).

Harmonics 4 and 6 have been skipped because they are just doubles of harmonics 2 and 3 but one octave higher, meaning you can "fake" them easily enough. Harmonic 4 is also accessible by using Harmonic 3 and setting your original note a perfect 4th (5 semitones) higher.

To emulate a pick squeal/pinch harmonic, try a combination of Autopicking and Harmonic 5 or 7. If the Velocity is low and the gain is high, the pick rub really comes through.

Appendix 2 – Version History:

1.0 [2018-07-08] First Feature-Complete release.

1.1 [2018-09-07]
- Palm mute mode now split by velocity. 92+ is a short, hard mute while 91- is longer and less abrupt on the attack.

1.2.1 [2018-11-09]
- Ella Gitauru (steel string acoustic) added to BJAM.

2.19.12 [2019-12-27]
- This identifies as a new instrument, so if you already have BJAM/Ella 1.x, you will not lose them by adding BJAM 2. This also means you never have to migrate projects you're already happy with.
- Sustain mode has been rendered unnecessary (the new samples have immensely more sustain than 1.x) and dropped.
- Keyswitch layout overhauled.
- Mute Long mode added, old "Mute" is now Mute Short.
- Mod Rate knob added.
- BJAM only: All pickups were sampled simultaneously, so the outputs of both channels are in time and in phase to allow pickup mixing.
- BJAM only: All pickups available from a single instrument, which replaces the 12-string functionality.
- BJAM only: Noises are by keyswitch rather than always on, no more round-robin on chucks and swipes since they have single keys now.
- BJAM only: Mute Short mode split by velocity. 111-127 is ff and has an 800 ms decay time applied.

2.20.09 [2020-09-12] – the Acoustic Smoothing update. All changes are to Ella G alone.
- **Ella G 2.20.09 is a beta and subject to change**, which is why the stable (2.19.12) is also included.
- Left (6–string) channel corrected for the 19th/20th harmonics being much too loud on the 2B/1E strings. The original sound remains on the right channel. 5A "whine" around 2.3 kHz mellowed. 4D replaces 3G sample for normal plucked notes. 2B "Thump" minimized.

2.20.10 [2020-10-13] – the Autopicking update.
- Both BJAM and Ella G have received the same pair of features, and they operate in the same way.
- Ella G 2.20.10 replaces 2.20.09 with the addition of the Autopicking and Autoswiping features. These features will not be backported to 2.19.12.
- BJAM: Same filename used, so this will replace the previous **BJAM 2.mse** file if you have 2.19.12 installed. If you leave the CC17 and 18 parameters at zero, the only change (other than bug fixes) is the increased attack time when playing softly.
- BJAM: Fixed some Harmonic 5 and 7 samples that were not properly detuned.
- Both: Longer attack time on minimum velocity group, mostly to support a convincing effect in Autopicking mode. (23 ms becomes 123.)
- This is the last iteration of BJAM 2 (including Ella G) as a Maize Sampler instrument.

3.20.10 – The Great Migration to SFZ [2020-11-02]

- BJAM/Ella 2 is still available just in case someone can't make the SFZ version work, but no further support will be promised. (You might get answers/bugfixes, you might not.)
- Aside from creating some "7B pick" samples, there are no new samples compared to BJAM/Ella 2. Similar use (ignoring new features) should get similar results.
- Noises mode is no longer required, as the second octave has been cleared of keyswitches.
- Pitch bend, while still defaulting to ±2 semitones, can be changed within the SFZ handler as desired.
- **CC2** (breath) controls a 0 to 24 dB signal boost at the output.
- **CC3** (normally unassigned) controls modulation rate: 3 to 8 Hz. Maximum modulation depth = 120 cents.
- BJAM: **CC94** controls fine tuning, and total range is ±10 cents. Changing CC94 will not affect any non-note noises such as swipes or chucks.
- Ella G: Detuning of the upper octave strings is now controlled by **CC94**. The default remains +4 cents, and total range is ±10 cents.
- With the use of **CC16 to CC19** to control pickups or 6/12 string balance, it is no longer necessary to abuse stereo output to do two things at once. A Pan or Mix insert is no longer required or recommended.
- **Autopicking** and **Autoswiping** have moved to **CC14** and **CC15** (both normally unassigned) to accommodate the pickup volume controls. **CC9** alters the pitch of pick noises, automatic or otherwise.
- Full (3-band plus hi-cut) **"tone stack" EQ** added to both instruments, controlled by **CC20 to 29**.
- SFZ instruments lack pretty graphics and require you to have Sforzando or ARIA or similar, but they can be made very compact and feature-packed. There is no going back.
- To save space, samples are shipped in OGG format (10/10 maximum quality).

3.20.11 [2020-12-02]

- Ella G: Noises reorganized along the lines of the BJAM layout: first Chucks and Swipes, then Thump-Slap-Knock-Tap, then six Picks.
- **Dive Bomb** or **Neck Dive** (CC31) bends each string downward a different amount. **BJAM:** The deflection is large, and modeled on the floating bridge of the sampled instrument. **Ella G:** The deflection is small, simulating bending/twisting the neck.
- **Harm2 Tuning** (CC93) now affects only notes triggered with the Harmonic 2 keyswitch. Range of effect changed to 0-200 cents (+ only).
- Previous **Fine Tuning** (CC94) now affects only Solo Mode and H-P-S Mode, to allow easier swapping between bent and not-bent notes, and overlap of repeated notes. Range of effect changed to 0-200 cents (+ only), renamed **Solo Tuning**. Ella G 12-string detune moved to CC19 to make room for this.
- Slap & Pop and Fifth Position trade assignments within the keyswitch octave. **Fifth Position** is now **C#-2**, and **Slap & Pop** is now **A#-2**. This makes all the "normal" playing modes fit into one solid block of keys from **C-2 to E-2**.
- CC22, 25, 28 now control the width of the EQ bands.
- Many defaults and ranges converted to **#define** statements and moved to the top of each SFZ, for easier editing by the end user.
- Versions of the SFZ with the Tone Stack commented out are provided for situations where CPU usage is a concern.

3.20.12 [finalized 2021-01-01]
- **Harm2 Tuning** and **Solo Tuning** have been removed, and their functions replaced by Per-Pitch-Class tuning.
- **Per-Pitch-Class tuning** implemented using CC36 to CC47.
- **Per-Pitch-Class volume** implemented using CC48 to CC59.
- **Breath Boost** (CC2) and **Autoswiping** (CC15) have been removed to free up CC slots for future expansion.
- **Pick Pitch** moved from CC9 to CC10, since CC10 cannot be purged from Controls even if it is not used or defined so I might as well recycle it.
- **Autoswiping** (CC15) also removed to free up one critical CC slot for future expansion.
- **Dive Bomb/Neck Dive** (CC31) reworked to bend in the expected direction, and to be centered at 83% (106/127) so slight upward bending is also possible.
- **Mute Mix** (CC71) allows "softening" of muted notes by mixing with less-muted or not-muted samples.
- **Fundamental** (CC72) allows the base note to leak into all harmonics as a "chug" if set higher than 0.
- **Ella:** Maximum top frequency for the lowpass filter and third EQ band changed to 11025 Hz to match BJAM. Both Tone Stacks are now identical.
- All names for the MIDI CCs now have the default value embedded as a superscript.
- Multiple demos that previously required two instances have been reworked to use pitch class tuning and now require just one instance per guitar.
- SFZ files internally reorganized for easier maintenance. This requires the use of the `<master>` tag, which may or may not be supported by non-ARIA players. Also abstracts away direct handling of key events to `#include` files.

3.21.01 [finalized 2021-01-31, except for minor tweaks that don't change the sound]
- EQ Width controls removed to free up CCs in the Control screen, set to 1.4 octaves.
- Sostenuto pedal (CC66) is now an alternate way to engage Hammer-Pulloff-Slide mode, except when you are in one of the Harmonics.
- Ella Gitauru samples have been processed to reduce noise, particularly on long sustained notes. Demos updated.
- Keyswitches now tied to a block of `#define` statements in the main SFZ file, in case you want to change them. [Added 2021-02-13]
- BJAM range extended to **B-1** rather than leave a dead note. [Added 2021-02-14]

3.21.05 [2021-05-10]
- EQ Width controls consolidated into CC70. This affects all three EQ bands. Default width is 1.4 octaves.

3.21.09 [2021-09-12]
- Documentation updated noting the use of "key 60 = C3" notation and providing key numbers in many places.
- **Ella G only:** Inverted "Nashville" volume function added to CC18 in all keyswitch modes.
- There are no functional changes to BJAM, only minor comment edits, so the version number remains at 3.21.05.

4.22.03 [2022-03-31, bug fix 2022-04-21]

- **Reactive Tone Modeling** feature (CC 28) added, replacing Hi-Cut feature (CC 29). On average, this makes the tone of both instruments noticeably darker, so the acoustic needed brightening up per the next point.
- All **Ella G samples have been high-shelved** to add treble. A Tone Booster should no longer be required, and you will probably want to alter any existing EQ settings.
- **Tone Stack now disabled** as shipped. If you want to enable it, find the line that reads `//#include BJAM 4/includes/Tone Stack.sfz` and remove the `//` part. You will need to do this once each for BJAM and Ella G.
- Default startup keyswitch changed from **C-2 (key 0, Open position)** to **D-2 (key 2, Solo Mode)** because Solo Mode is more of a One-Size-Fits-All solution than Open Position is. Once you actively choose a keyswitch, this no longer matters.
- **Swipe sounds** (whether there are Short and Long swipes, or just the one set) now **stop at the detection of the next note**. The note need not be perceptible, but keyswitches will not stop a swipe because that's exactly when you want a hand shift. Swipes will also coexist with ringing notes as long as the swipe starts later than the note, since they could be open strings.
- **Bug Fix:** Requests to load `legato.sfz` have been correctly redirected to `legato-solo.sfz`.

4.22.05 [2022-05-18]

- **Phase Delay** feature (CC 60, 61 [, 62]) added to pickups (BJAM) and 6-String/ Nashville (Ella). This delays signals from that source only, up to 23 ms. Uses x^2 curve so it ramps up fast past 50%. (If there is an Invert option, it uses the same delay.) For BJAM this represents the time it takes for a pulse to move along the string from one pickup to the other. For Ella G, this represents the time offset between the 6-String and Nashville notes sounding, in either order (for up vs. down picking).
- **Warning: Not enough CC slots in Controls to enable Tone Stack.** You can still do it, but it will slightly break the GUI (because there's only room for 48 CCs), and you will become unable to access the highest CCs by mouse and GUI.

4.22.06 [2022-06-24]

- **Spank** (CC 71, formerly called Mute Purity) affects the mixing of Slap & Pop Mode.
- Slap & Pop samples attack-aligned with the normal *ff* sample. Some phasing effect remains due to differing rates of pitch glide, something I don't currently know how best to address.

4.23.04 [2023-04-12] – BJAM only updated, Ella G remains at 4.22.06

- **LH** (left hand) **Muting** is enabled by **CC67** (Soft pedal). This has the LH fingers all placed to mute the strings without pressing down, and tracks where left hand is on the neck so three separate sets of samples have been added (Solo Mode uses all three). **CC10** (Pick Pitch) has been enhanced to bend ghost notes as well as pick taps.