

**LushOne Synth 103**  
**Advanced effects**

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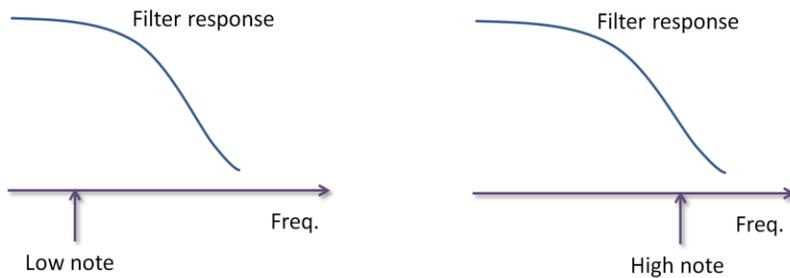
## What are we going to do?

- Track the filter response based on the note being played
  - More consistent sounds
- Modulate the OSC1 frequency with the LFO
  - Wider sound pallet

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## Limitations so far

- Cut-off frequency of the filter doesn't track the note being played
- Different notes sound different
  - Try playing over several octaves

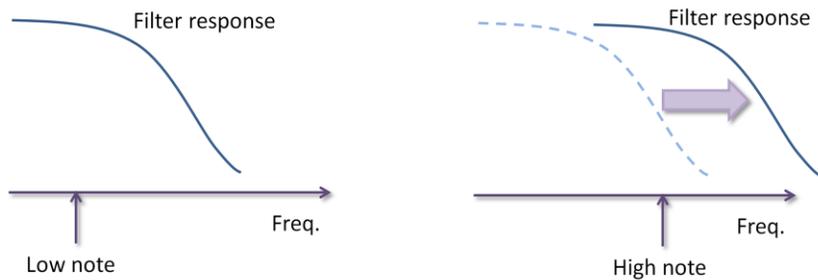


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So far we haven't made any connection between the cut-off frequency of the filter and the note being played. The filter always behaves in the same way and this means that the filter response curve is in a different relative position for each note and different notes sound different.

## What we want

- Cut-off frequency to track note being played
- Filter response shifts to same relative position for every note



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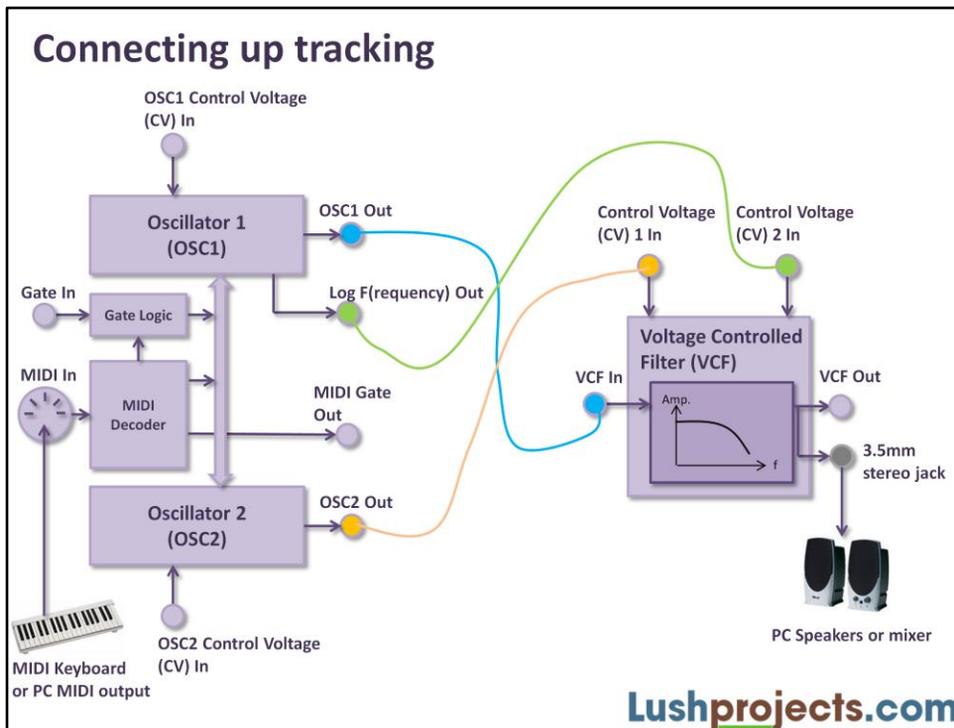
For consistent response we would ideally shift the filter so that the filter response is in the same relative position for each note.

## Achieving tracking

- Send the note frequency as a control voltage input to the filter cut-off
- Normally use a “log” voltage representation of frequency as this corresponds to human perception of sound
- Higher end systems have calibrated inputs and outputs
  - Often 1Volt/octave
- LushOne has a “Log F” output of approximately 0.65Volts/octave (uncalibrated)
- Gain on the control voltage input to filter can be tuned by ear to get desired tracking

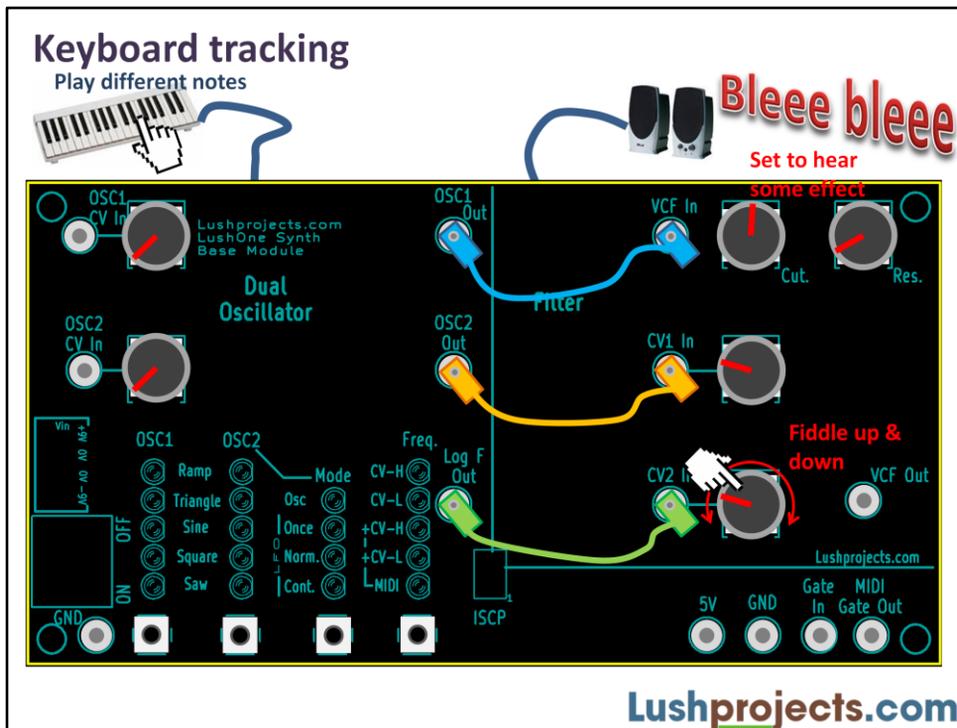
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The “Log F” output on the LushOne represents the frequency of OSC1. By connecting this output to a control voltage input of the filter you can make the filter cut-off track the OSC1 frequency.



Patch the “Log F” output to a “Control Voltage” input on the filter. You can keep the OSC2 output connected to the other control voltage input to combine both effects. The control voltage inputs are identical and can be connected either way round. For simplicity in the text we always connect OSC2 to CV1 and Log F to CV2.

The control voltage inputs to the LushOne filter are approximately Logarithmic. The gain controls allow the sensitivity to be adjusted.



Patch the Log F output in the CV2 input. Start by setting the master filter cut-off to hear some filter effect on a middle keyboard note. Keep the CV1 gain (controlling the LFO input) low to make it easy to hear the tracking effect. Now try playing notes over several octaves while adjusting the CV2 gain. You should find that with the CV2 gain set to about 30% the filter cut-off tracks the keyboard note and all notes have similar quality and volume. You can increase the CV2 gain to get exaggerated tracking or reduce CV2 gain to get a reduced tracking effect.

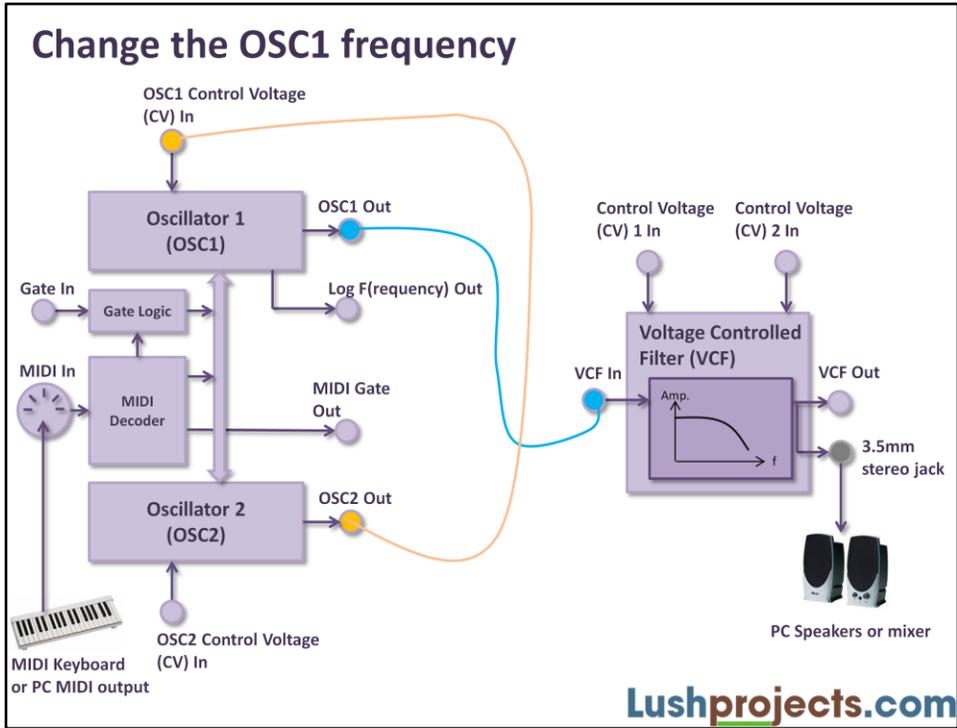
Because the CV2 input always adds something to the mix there is an interaction between the CV2 gain and the master filter cut-off control. You may need to adjust both to get the effect you want.

With the tracking set up how you like it you can now explore the full range of sounds generated by using all the controls explained so far.

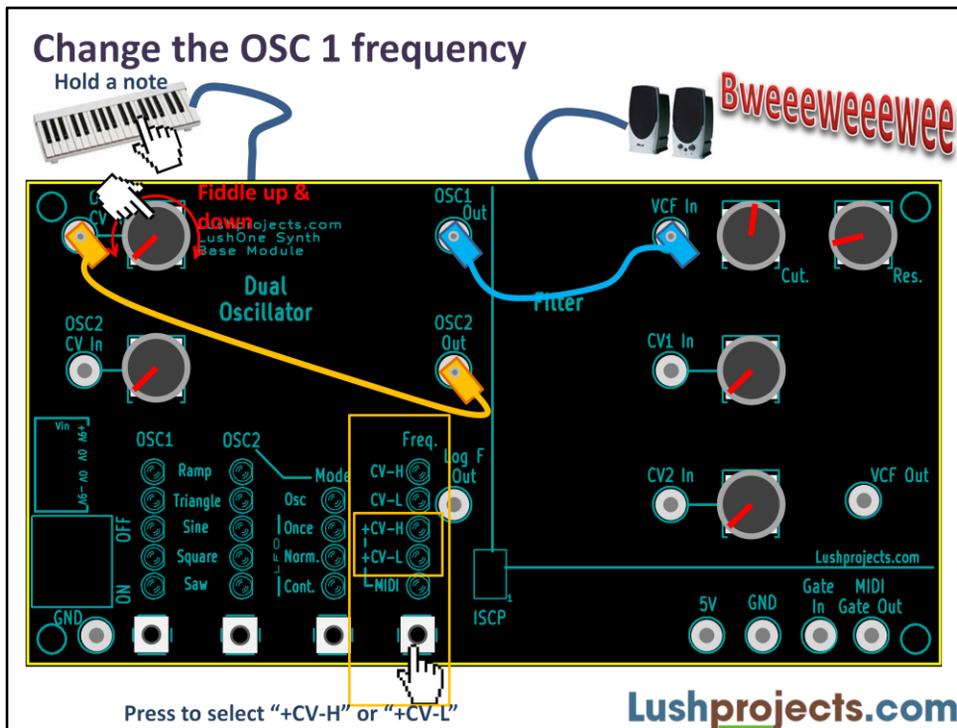
## Modulate OSC1 frequency

- We've now explored the use of the control voltage inputs for the filter
- Let's look at the oscillator control voltage inputs
  - By default the oscillator control voltage inputs are disabled to keep the tuning accurate to MIDI
  - The "Freq." mode (fourth button) can enable the control voltage inputs
- The OSC2 output can be patched in to the OSC1 control voltage
  - And may also be patched in to a filter control voltage

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Patch the OSC2 output to the OSC1 control voltage input. It will also be necessary to set the "Freq." mode as shown on the next slide.



Patch the LushOne as shown above. Press the fourth button to change the “Freq.” mode to “+CV-H” or “+CV-L”. The first three modes are:

### Freq mode: MIDI

OSC1 and OSC2 only respond to MIDI input (note for OSC1 and modulation for OSC2). The control voltage inputs are ignored.

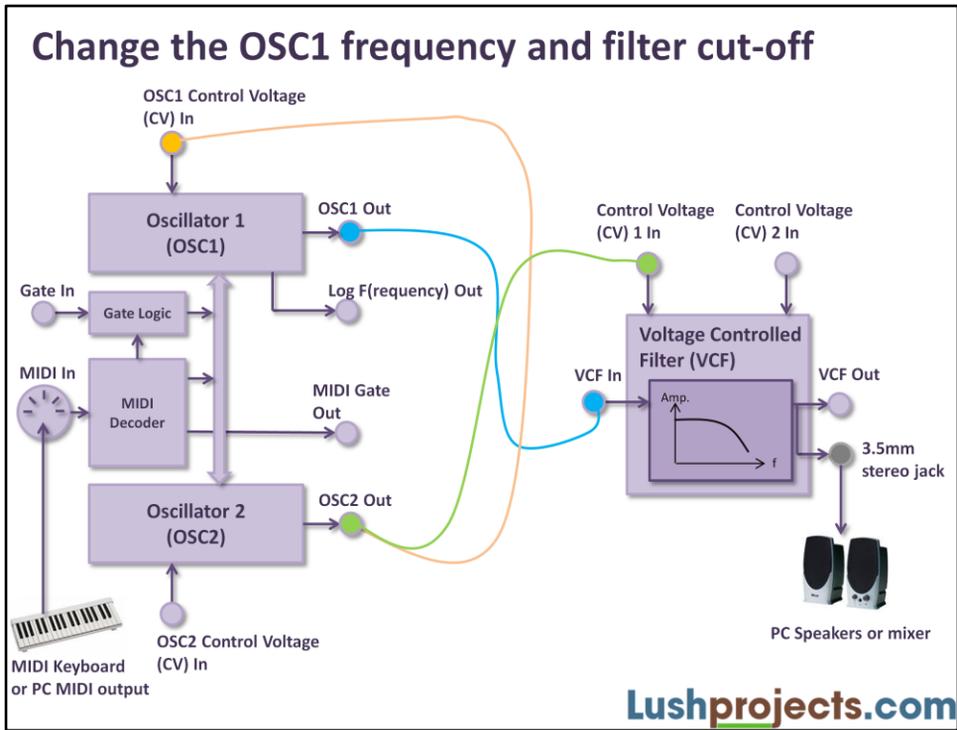
### Freq mode: MIDI+CV-L

OSC1 and OSC2 respond to MIDI input to which is added the corresponding control voltage input. The control voltages have low sensitivity and only shift the oscillator frequency over a small part of the range. You probably want to use this mode for most cases where you are modulating a MIDI signal.

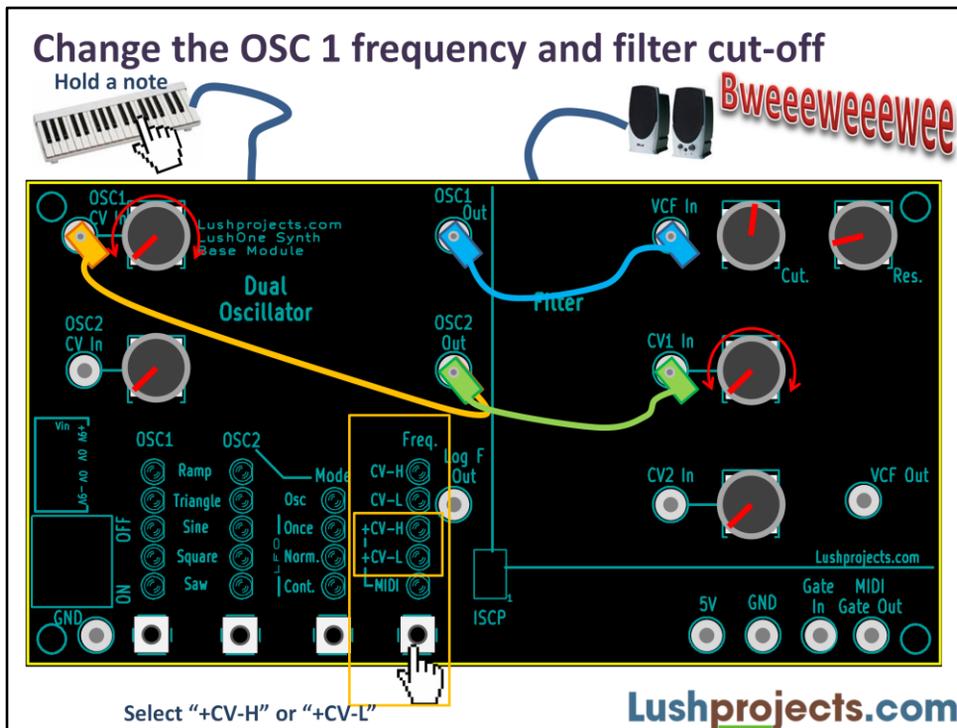
### Freq mode: MIDI+CV-H

OSC1 and OSC2 respond to MIDI input to which is added the corresponding control voltage input. The control voltages have high sensitivity and only shift the oscillator frequency over the full frequency range.

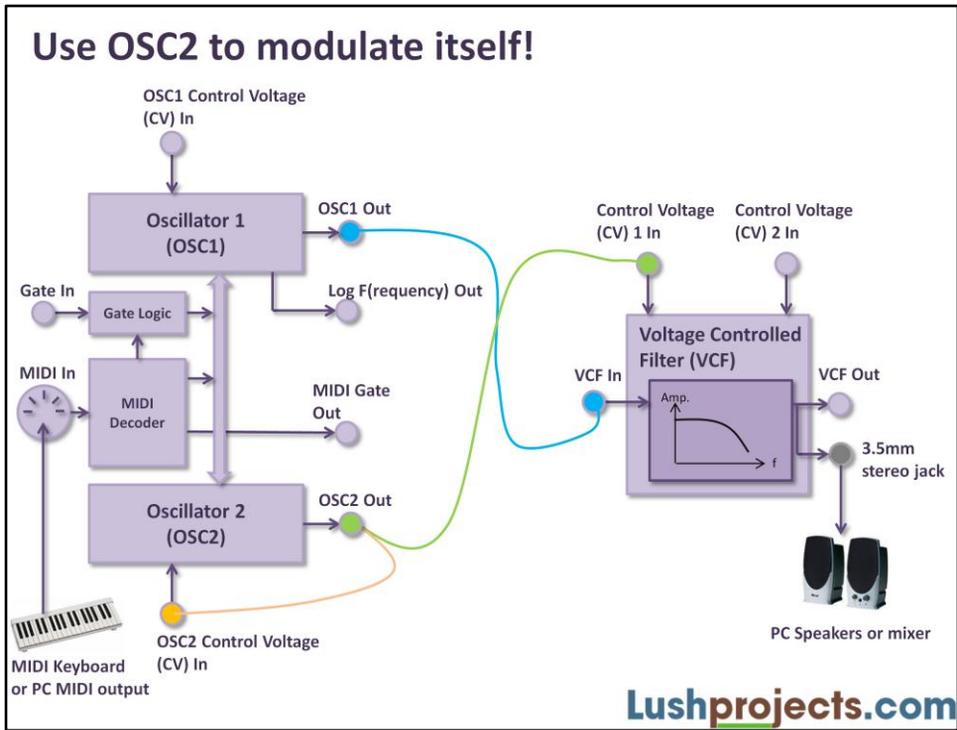
With the Freq. mode in +CV-L or +CV-H try turning up the gain control for OSC1 CV. You should hear the frequency of the note start to be modulated by the OSC2 LFO.



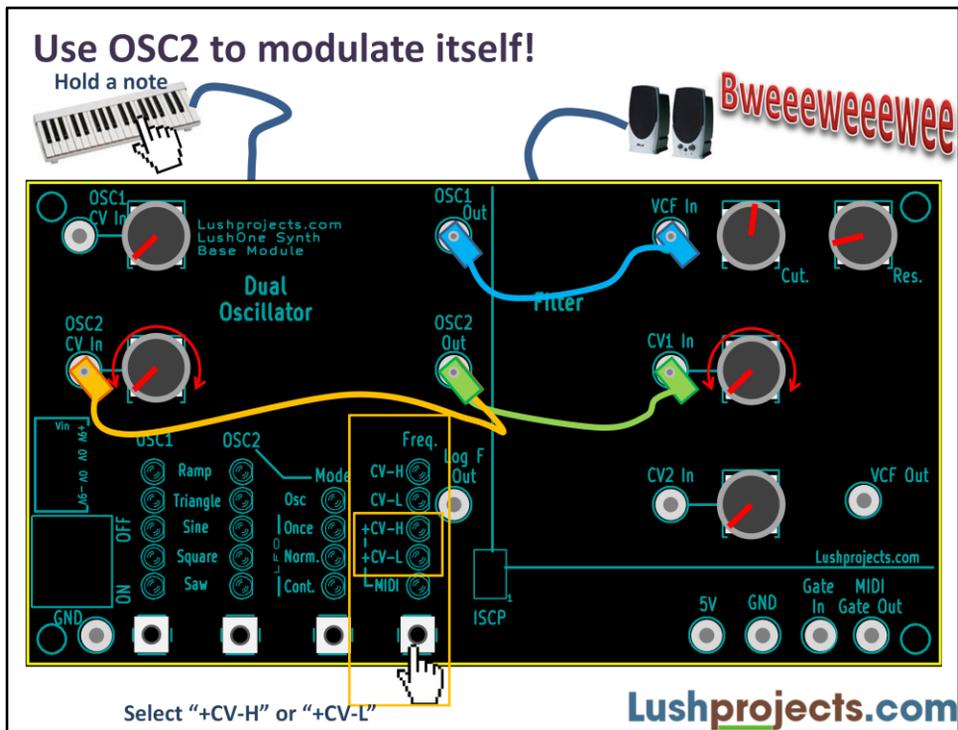
You can patch the OSC2 output to multiple inputs



In general one output can be connected to several inputs – here we use the OSC2 output to modulate both the OSC1 CV input and the filter CV1 input. The stacking 2mm connectors allow several leads to be connected to the same socket.



You can even try patching OSC outputs back to the control voltage inputs!



Probably not very useful, but technically possible – OSC2 can modulate itself leading to asymmetric waveforms.

## Recap

You've now explored pretty much all the capabilities of the LushOne that don't require any external electronics.

- Use the Log F output to make the filter track the note frequency
- Use the oscillator CV inputs to modify the oscillator frequency in response to a signal

Go and make some noise.

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## Next time

- LushOne 104
- Interfacing with external circuits for more effects and expansion

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