Advanced Coding Tools and Methodologies

Prof. **Francesco Bruschi**

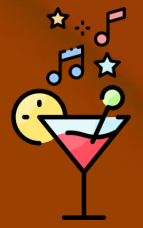
Prof. **Vincenzo Rana**

Music and Acoustic Engineering M.Sc.

Student

Marco Muraro

SubJuicy



Subtractive Synthesizer

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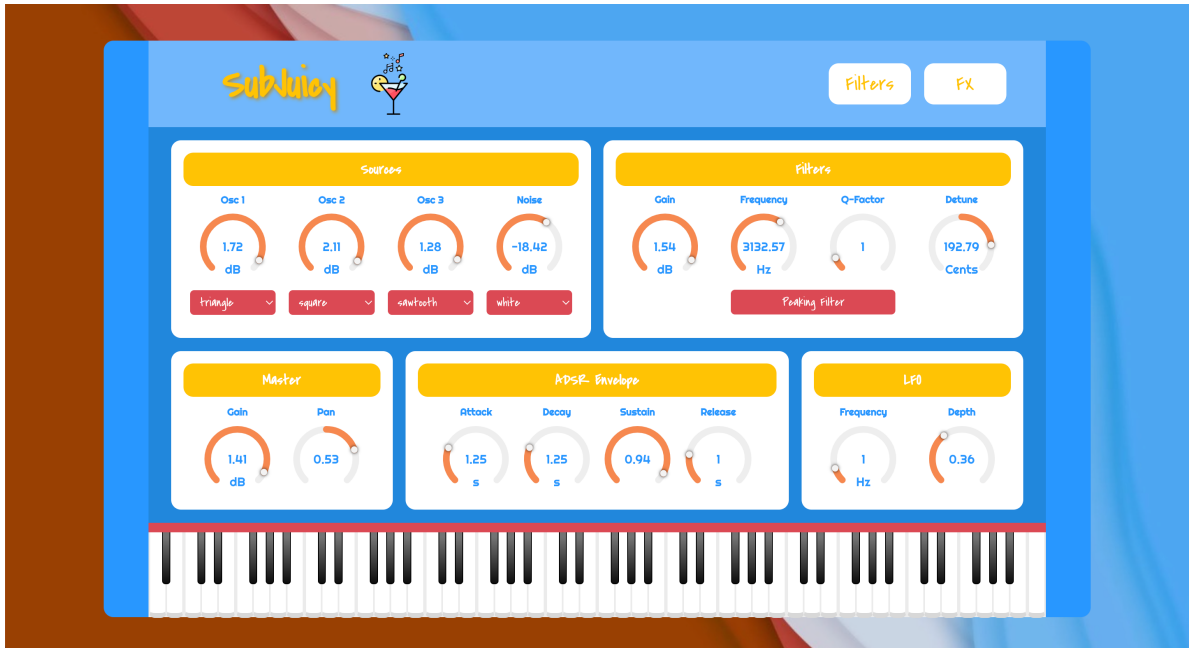

SubJuicy

Vue3 Web App

Monophonic synthesizer based on subtractive synthesis

Libraries employed

- **Vue.js**
- **Tone.js**

Web MIDI API is exploited to manage MIDI device connection and messages

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Vue.js

Progressive JavaScript Framework for building web user interfaces

Approchable

Builds on top of standard HTML, CSS and JavaScript

Performant

Truly, reactive compiler-optimized rendering system

Versatile

Rich, incrementally adaptable ecosystem

Vue CLI Standard tooling baseline for Vue ecosystem

Tone.js

Web Audio Framework for creating interactive music in the browser

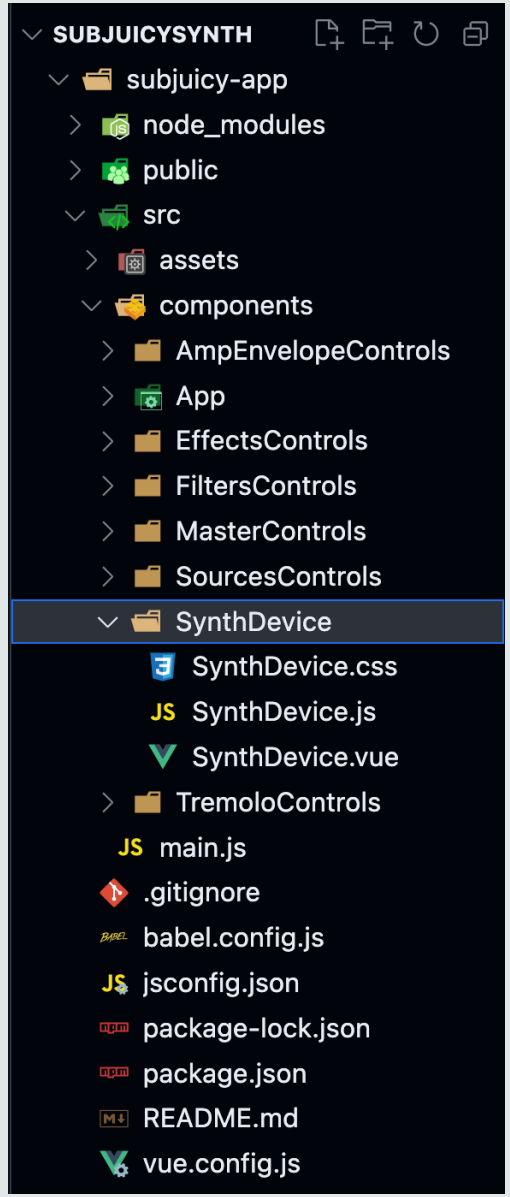
On the **high level**, Tone.js offers

- Common DAW features like global transport as well as interesting prebuilt synths and effects of different nature
- High-performance building blocks to create your own synthesizers, effects and complex control signals

App Architecture

Functional macro-sections integrated within the GUI of SubJuicy app are implemented as **Vue components**

- **Independent and reusable blocks** that are integrated in the app
- Vue **apps** are commonly **organized into nested components**
- Vue implements its own **component model** that allows us to encapsulate **custom content and logic** in each one of them



Single Component

MasterControls.vue | MasterControls.js | MasterControls.css

subjuicy-app > src > components > MasterControls > MasterControls.vue > { } style scoped

```vue
<template>
    <div class="component-wrapper flex-container-col">
        <div class="title-container">
            <h2>Master</h2>
        </div>
        <div class="flex-container-row controls-wrapper">…
        </div>
    </div>
</template>

<script src="./MasterControls.js"></script>

<style src="./MasterControls.css" scoped></style>
```

MasterControls.vue | MasterControls.js | MasterControls.css

subjuicy-app > src > components > MasterControls > JS MasterControls.js > default

```js
import RoundSlider from 'vue-three-round-slider'

export default {
    name: 'MasterControls',
    components: {
        RoundSlider
    },
    props: {
        synthState: Object
    },
    data() {
        return {
            roundSlider: {…
            },
            masterGain: this.synthState.master.gain,
            pan: this.synthState.master.pan
        }
    },
    watch: {
        masterGain() {…
        },
        pan() {…
        }
    }
}
```

MasterControls.vue | MasterControls.js | MasterControls.css

subjuicy-app > src > components > MasterControls > MasterControls.css > ...

```css
.component-wrapper {
    box-sizing: border-box;
    width: 100%;
    height: 100%;
    border-radius: 12px;
    padding: 15px;
}

.title-container {
    width: 100%;
    border-radius: 12px;
    background-color: #ffc304;
}

.controls-wrapper {…
}

.knob-wrapper {…
}

label {…
}

.unit-of-measure {…
}
```

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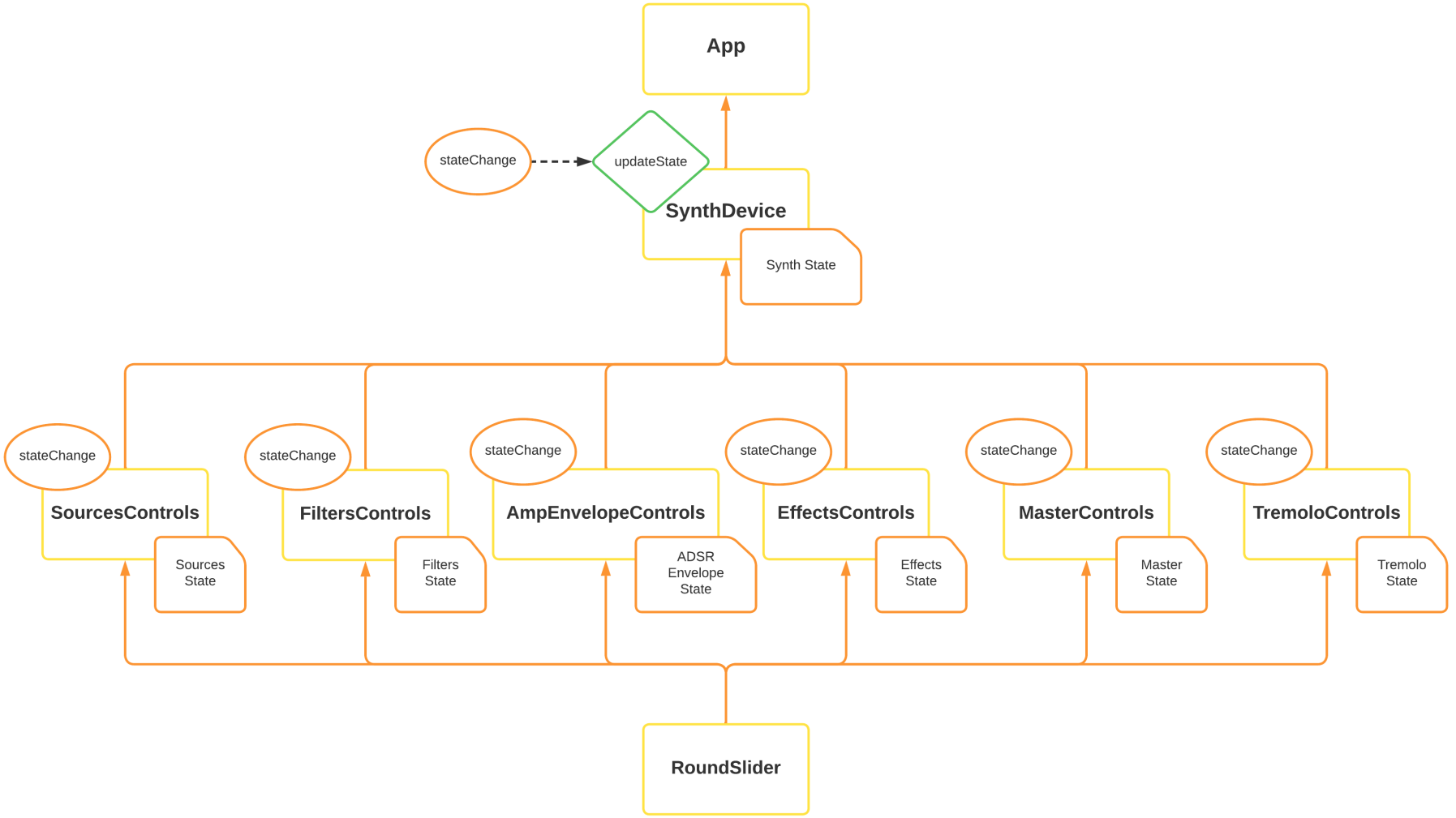
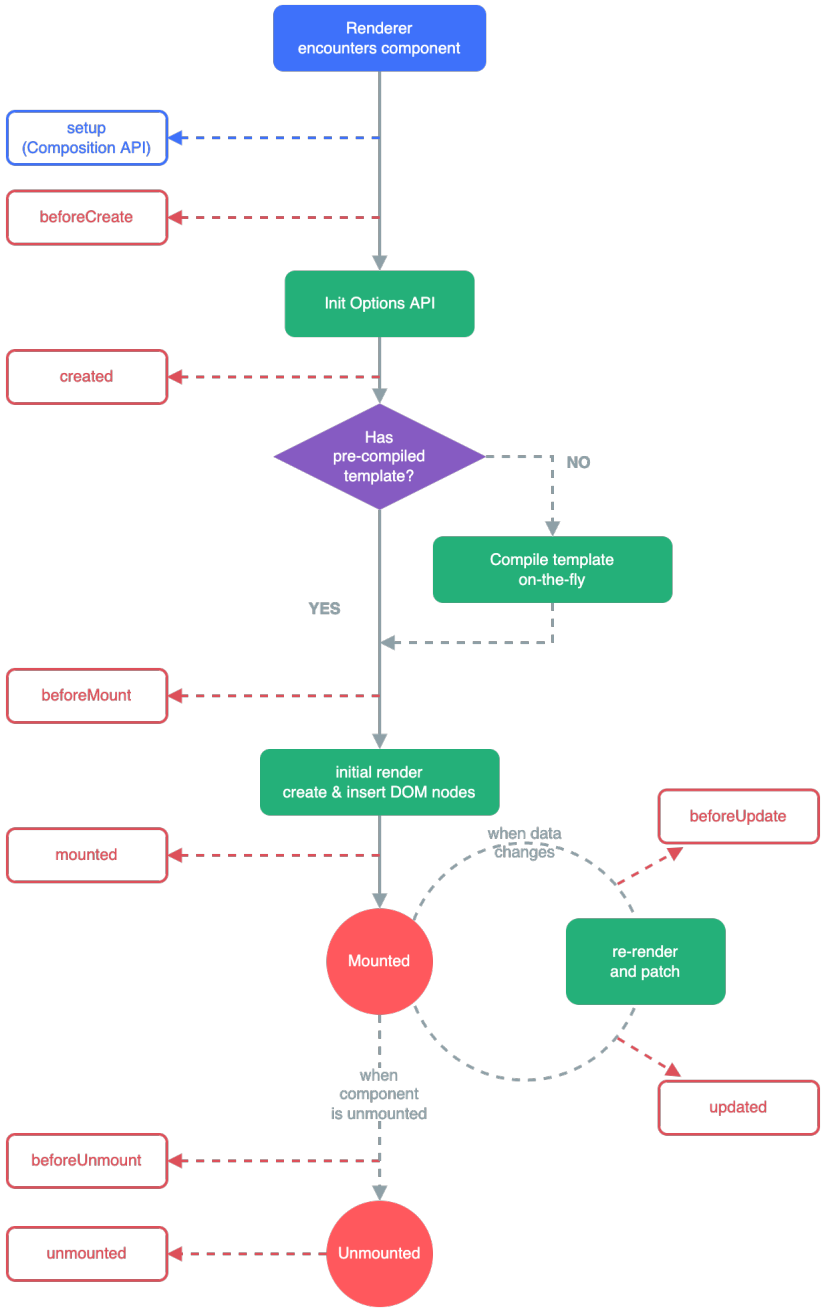
App Architecture





Lifecycle Hooks

Each Vue component goes through a series of initialization steps when it's created and then mounted to the DOM

Along the way, Vue runs functions called **lifecycle hooks**

Developers can add their own code to be executed at specific stages during lifecycle of a certain Vue instance

SynthDevice.vue | SynthDevice.js | SynthDevice.css

subjuicy-app > src > components > SynthDevice > SynthDevice.js > default > created

```
404     created() {
405
406         /* ----- CREATE and INITIALIZE AUDIO NODES ----- */
407
408         // Sources
409         this.osc1 = new this.$tone.Oscillator({
410             'type': this.synthState.sources.osc1.type,
411             'volume': this.synthState.sources.osc1.volume
412         });
```

```
synthState: {
    sources: {
        osc1: {
            type: 'sine',
            volume: 0
        },
        osc2: {…
        },
        osc3: {…
        },
        noise: {
            type: 'white',
            volume: -50
        }
    },
    amplitudeEnvelope: {…
    },
    master: {…
    },
    lfo: {…
    },
    filters: {…
    },
    effects: {…
    }
}
```

Synth State

Synth state is defined as an object in the **SynthDevice component** within its data function

SynthDevice is the **heart of signal processing** for the whole app

synthState object is exploited to initialize all the audio nodes and is also passed as a property to all the child components for GUI controls initialization

```
this.peakingFilter = new this.$tone.BiquadFilter({
    'type': 'peaking',
    'gain': this.synthState.filters.peaking.gain,
    'frequency': this.synthState.filters.lowPass.frequency,
    'Q': this.synthState.filters.lowPass.quality,
    'detune': this.synthState.filters.lowPass.detune
});
```

State Update

SourcesControls.vue | SourcesControls.js | SourcesControls.css | SynthDevice.js

subjuicy-app > src > components > SourcesControls > SourcesControls.js > ...

```
38      watch: {
39          osc1Type() {
40              console.log('Osc1 Type chnaged:', this.osc1Type);
41              this.$emit("stateChange", {name: 'osc1Type', value: this.osc1Type});
42          },
43          osc1Volume() {
44              console.log('Osc1 Volume changed:', this.osc1Volume);
45              this.$emit("stateChange", {name: 'osc1Volume', value: this.osc1Volume});
46          },
```

SynthDevice.vue | SynthDevice.js | SynthDevice.css | SourcesControls.js

SynthDevice.vue > { } template > div#synth.flex-container-row > div#synth-panel.flex-container-col

```
22                  <div id="controls-panel" class="flex-container-col">
23                      <div class="controls-wrapper flex-container-row">
24                          <div id="sources-controls">
25                              <SourcesControls
26                              :synthState="synthState"
27                              @stateChange="updateState"/>
28                          </div>
```

SynthDevice.vue | SynthDevice.js

subjuicy-app > src > components > SynthDevice

```
184         updateState(update) {
185             switch(update.name) {
186                 case 'osc1Type':
187                     this.synthState.sources.osc1.type = update.value;
188                     this.osc1.type = this.synthState.sources.osc1.type;
189                     console.log('Osc1 Type updated:', update.value);
190                     break;
191                 case 'osc1Volume':
192                     this.synthState.sources.osc1.volume = update.value;
193                     this.osc1.volume.value = this.synthState.sources.osc1.volume;
194                     console.log('Osc1 Volume updated:', update.value);
195                     break;
```

v-model directive automatically updates child component state

Vue watchers are employed to *emit stateChange custom event* that is dispatched to the parent SynthDevice whenever the user modifies any synth parameter

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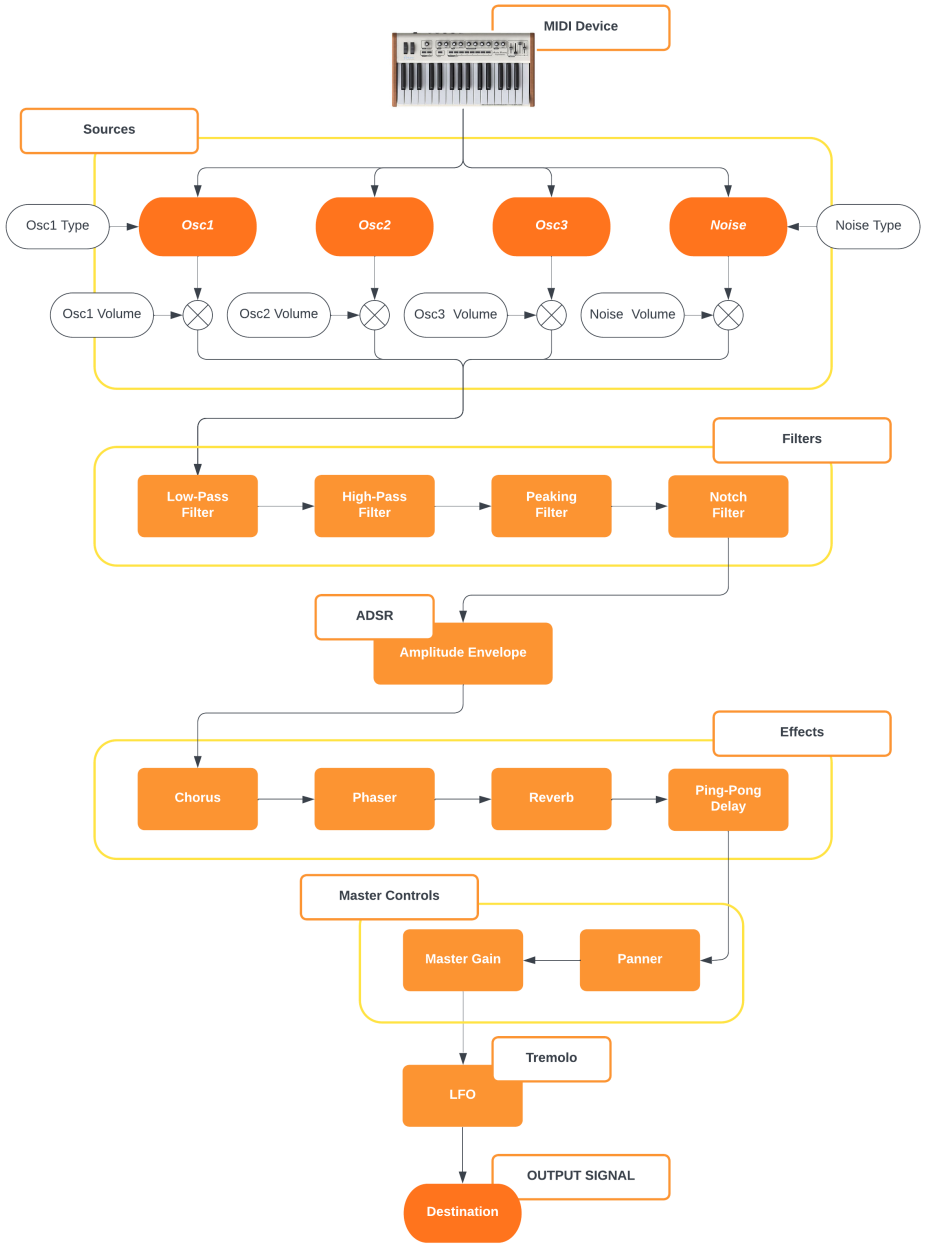

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Signal Flow

Signal processing is implemented through **Tone.js audio nodes** that are connected together to build the overall signal flow architecture


SubJuicy
Filters
FX
Sources
Osc 1
1.88
dB
Osc 2
1.58
dB
Osc 3
2.12
dB
Noise
-18.82
dB
sine
triangle
square
pink
Effects
Depth
0.74
Delay Time
5.44
ms
Frequency
1.5
Hz
Feedback
0.34
Wet
0.36
Chorus
Master
Gain
1.58
dB
Pan
0.74
ADSR Envelope
Attack
1.29
s
Decay
1.54
s
Sustain
0.91
Release
1
s
LFO
Frequency
1
Hz
Depth
0.39

Let's jump to

SubJuicy

...and make some music

https://marcomuraro4.github.io/SubJuicy/

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SubJuicy

Thank You

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