Particle Synthesis

A unified model for granular synthesis

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Overview

Granular synthesis

General characteristics

Specific subtypes (Roads)

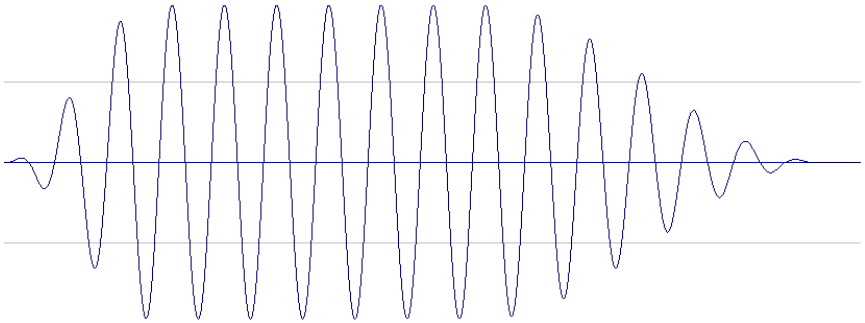
Particle synthesis – partikkel (Csound)

All in one generator

New features and new varieties of GS

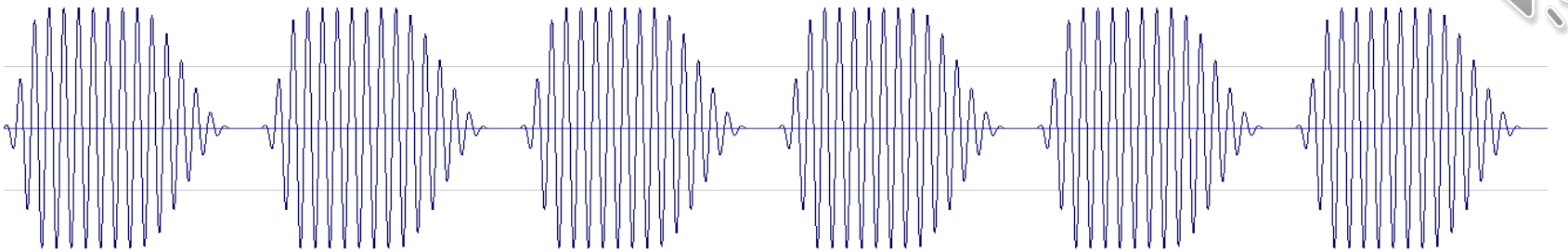
Interface and applications

General

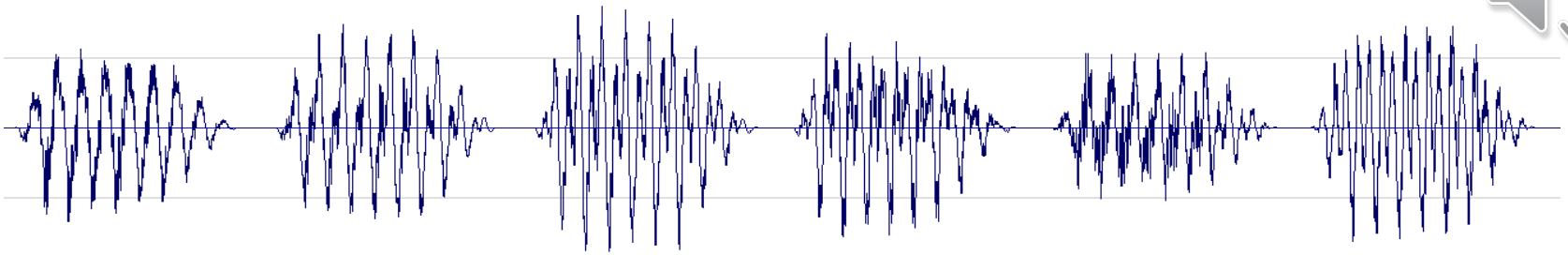


One single particle (grain)
consist of a short sound clip (waveform)

Waveform can be periodic and repeating (synthetic)



…or it can be an excerpt of a recorded sound



Basic parameters

Grain rate

Defines perceived pitch when rate is high (> 20 Hz)

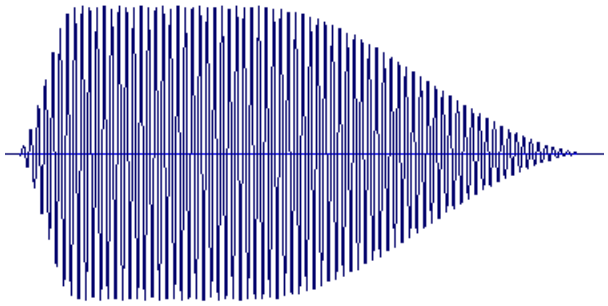
Grain pitch

Defines perceived pitch when rate is low and/or grains are long (> 50ms)

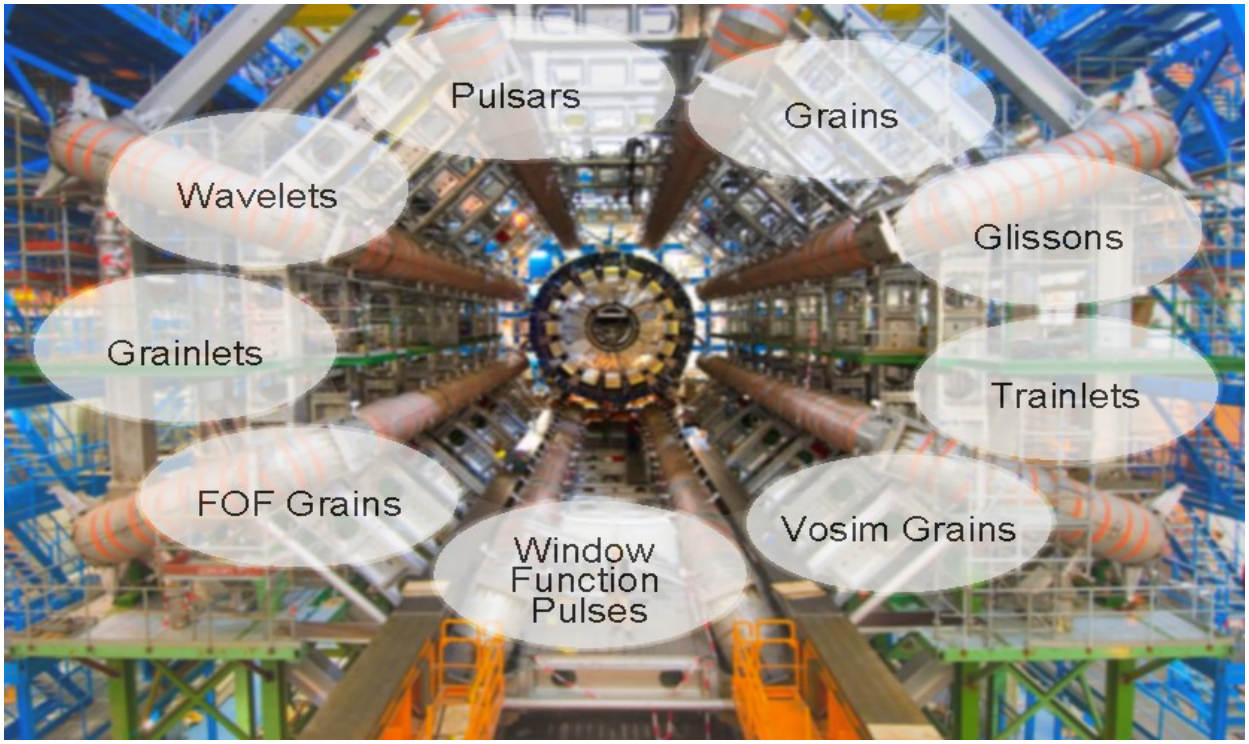
Grain shape

Attack, decay, sustain, duration

Grain waveform



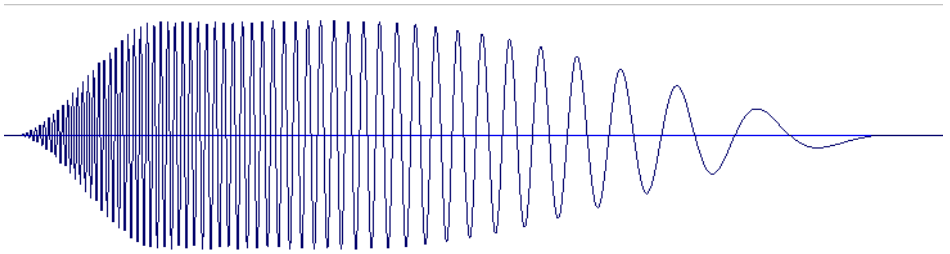
Varieties of particle synthesis



Previously: separate synthesizers/generators for each type

Main difference: parameter values (available parameter set)

Glissons



Pitch sweep within each grain

Converging

Diverging

Falling

Rising

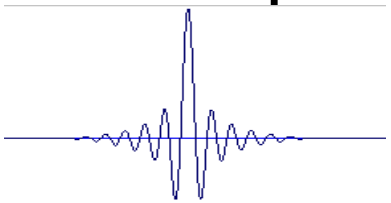
Separate control of start and end pitch

Frequency masking

Trainlets

Special case of source waveform

Synthetic waveform: band limited pulse train

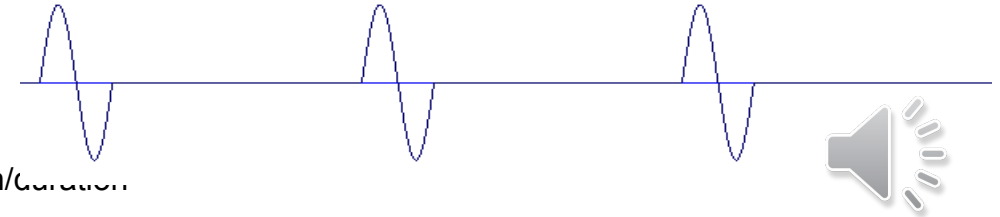


Base frequency

Number of partials

Chroma, harmonic balance

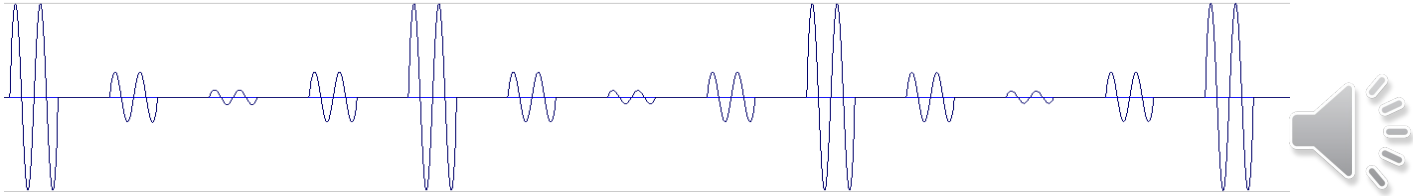
Pulsars



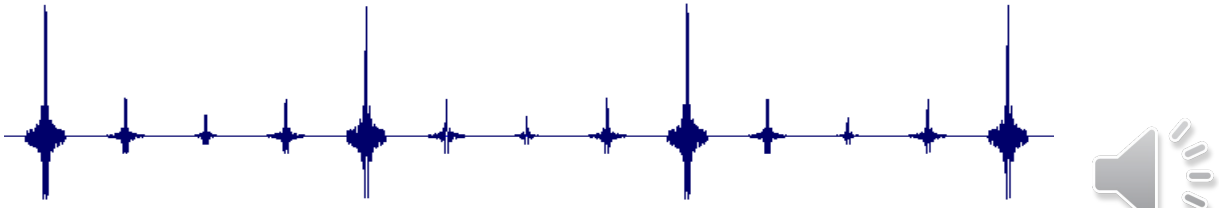
Pulsaret

Parameter linkage: rate/pitch/duration

Gain masking



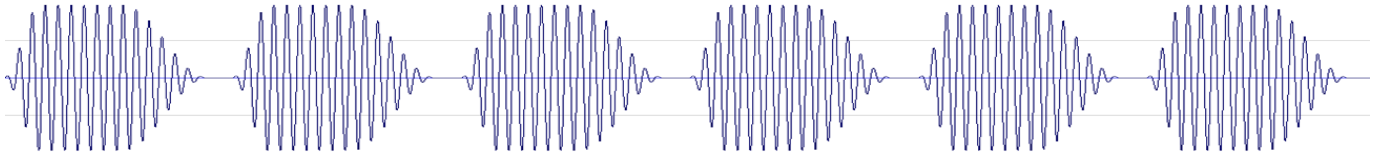
- Trainlet pulsars



Formant Synthesis

Grain rate constitutes perceived pitch

Grain pitch affects formants



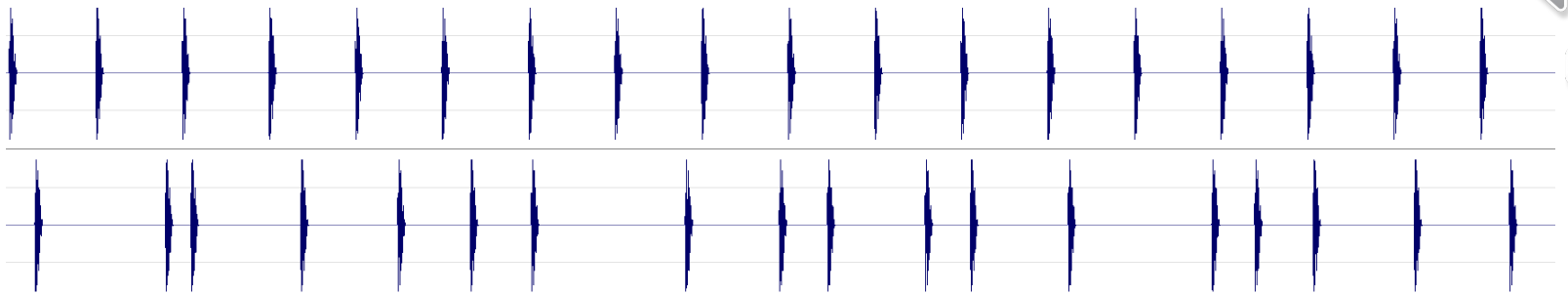
- Partikkel can use 4 separate source waveforms
  - Here: all 4 set to sine wave
  - Separate pitch for each source wave
- Male bass «a» … «e»

600 Hz, 0dB	400 Hz, 0dB
1040 Hz, -7dB	1620 Hz, -12dB
2250 Hz, -7dB	2400 Hz, -9dB
2450 Hz, -9 db	2800 Hz, -12 db

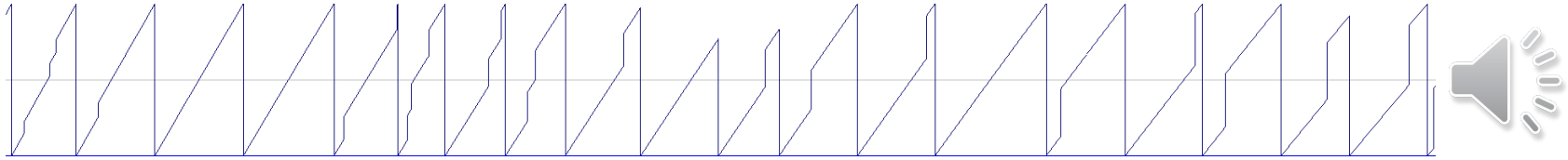
Grain clock

Synchronous / asynchronous / modulated

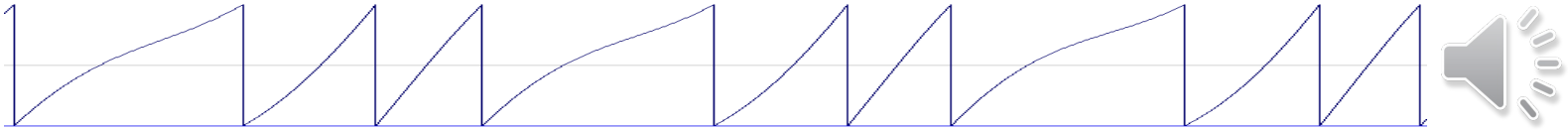
Grain Distribution



- External clock input
- Partikkelsync, clock output: Phase (ramp) and clock pulse



- Frequency Modulation on grain clock



Morphing

Sampled source wave, time modification

Sine

Glisson, converging sweeps

Trainlets

Pulsars

Formants

Asynchronous GS

Waveform mixing

Is it hard to use ?

40 parameters per note event

Some parameters are multidimensional

(Grain masking parameters)

Output routing,

mix of waveform sources

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These are put in tables

Format:

loop start, loop end, data1, data2, data3, …

…and as if that was not enough

Hadron Particle Synthesizer

Using partikkel and Csound as a DSP core

- Large set of modulators, freely assignable to all partikkel (and modulator) parameters
  - Envelopes, LFOs, Random generators
  - All midi input (note num, velocity, expression controllers)
  - Transfer functions, dividers, modulo
  - Analysis tracks: Transient, Pitch, Amp
- Feedback in modulator signals allowed
- 52 modulators, 209 parameters

Handling a large parameter set

Creates a need for new methods of parameter control

Hadron Particle Synthesizer

Parameter values and modulator routing defined in *states* (presets)

Expression controls for fine tuning

Morphing between states via XY control

Hadron Particle Synthesizer

Csound standalone, Max for Live, VST, AU

DSP library (Csound): LGPL

DSP application (CS orc/sco): LGPL

GUI elements: LGPL

GUI implementation (Juce, Max, M4L): LGPL

Hadron states files (parameter configuration)

Additional states files:

for sale, commercial

Thank you

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Hadron at Linux Sound Night tonight