

# LegendGeSim.jl

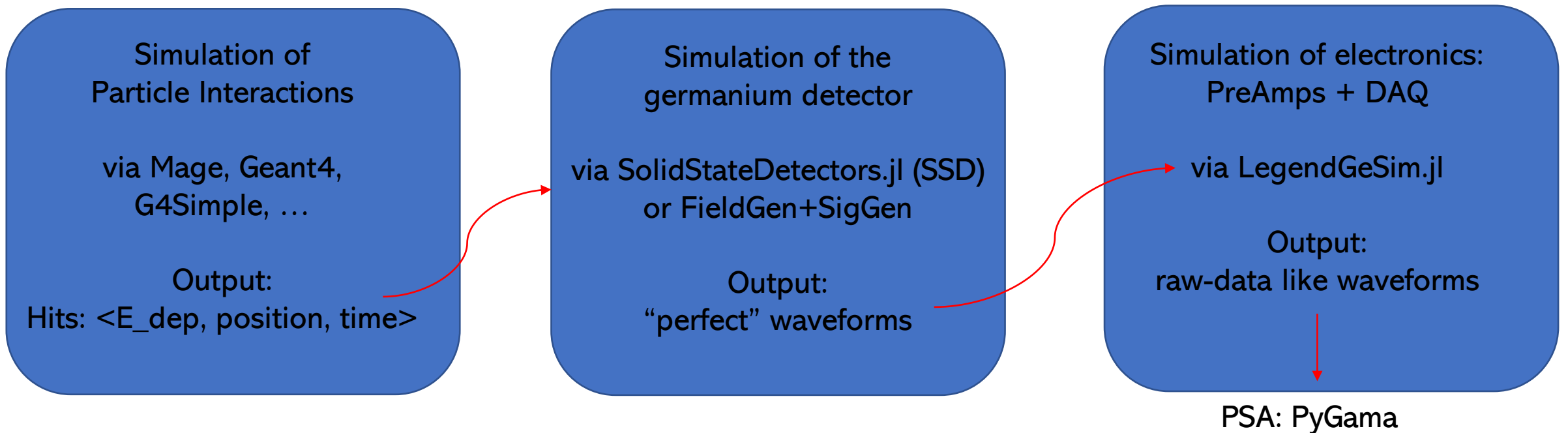
The package: <https://github.com/legend-exp/LegendGeSim.jl>

Main author: Mariia Redchuk

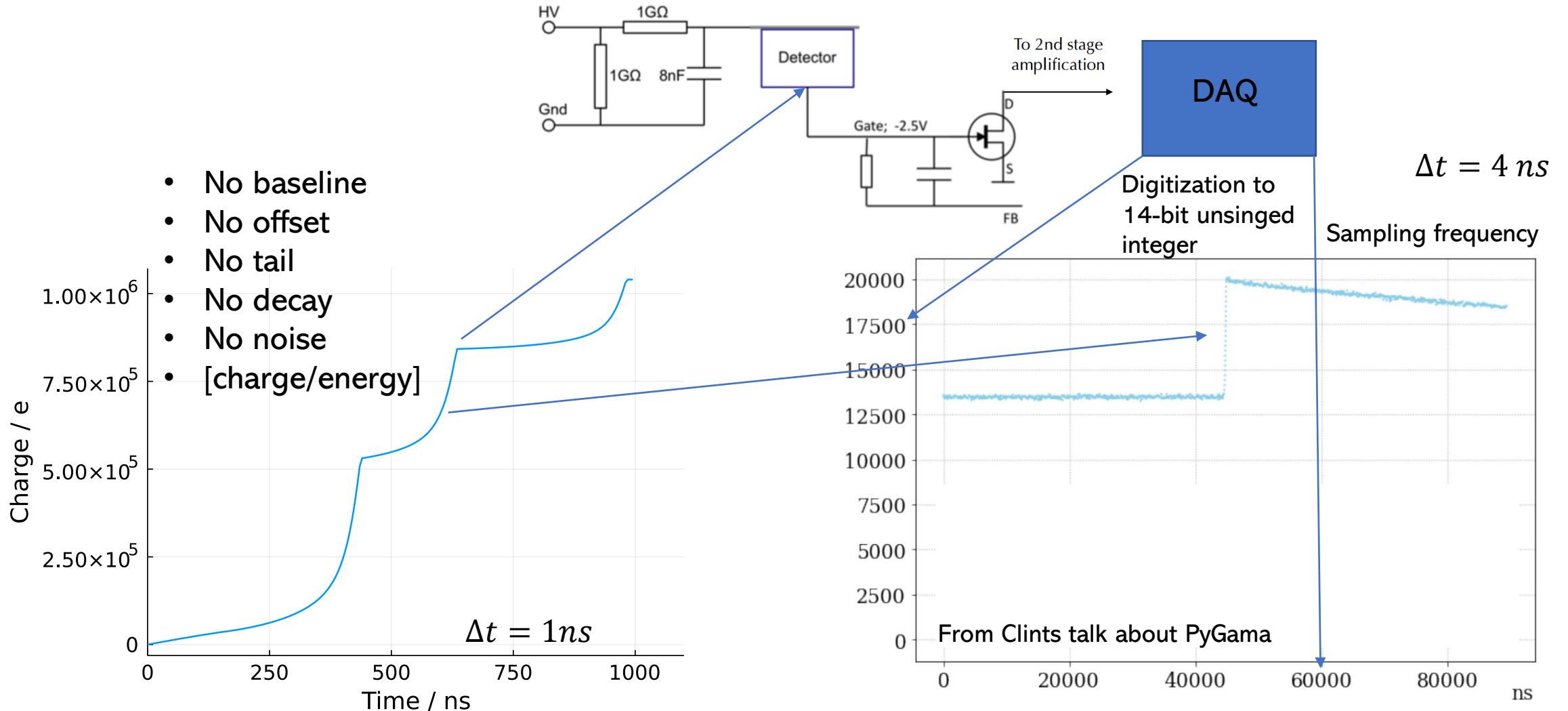
GitRepo for this tutorial: [https://github.com/lmh91/LegendGeSim\\_Tutorial](https://github.com/lmh91/LegendGeSim_Tutorial)

# What is LegendGeSim.jl?

It's a package to combine the different steps (and tools) of the simulation in order to produce raw-data like waveforms.



# Simulation of Electronics and DAQ



# Data formats of the different stages of the Simulation

Discussion officially not yet closed: <https://github.com/legend-exp/legend-data-format-specs/issues/1>

**pet** – Position Energy Time



preprocessing like clustering

**stp** – Stepping information



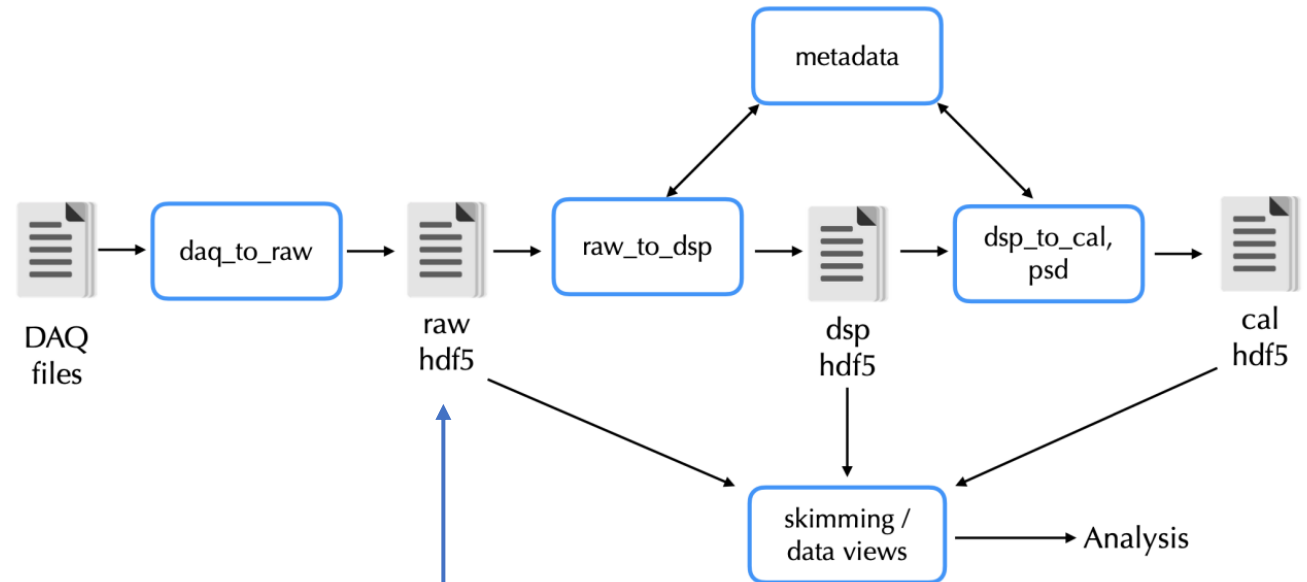
SSD / Field-SigGen

**pss** – Pulse Shape Simulation



Electronic filters

**raw**



From Clints talk about PyGama

# LEGEND Metadata Detector Files

```
1 {
2   "det_name": "Public Inverted Coax",
3   "det_type": "icpc",
4   "production": {
5     "manufacturer": "Nobody",
6     "order": 0.0,
7     "serialno": "X00000X",
8     "crystal": "000",
9     "slice": "X",
10    "enrichment": 0.9,
11    "reprocessing": "none",
12    "dep_voltage_in_V": 3500.0,
13    "rec_voltage_in_V": 4000.0,
14    "impcc": {
15      "array": {
16        "value_in_1e9e/cm3": [
17          11.0, 10.0, 10.0, 9.0
18        ],
19        "dist_from_contact_in_mm": [
20          0.0, 30, 50, 66
21        ]
22      },
23      "function_pars": {
24        "z0_in_1e10e/cm3": 0,
25        "gradient_in_1e10e/cm4": 0,
26        "quadratic_in_1e10e/cm5": 0
27      }
28    },
29    "delivered": "22-06-2021"
30  },
31  "geometry": {
32    "mass_in_g": 1700.0,
33    "height_in_mm": 80.0,
34    "radius_in_mm": 35.0,
35    "bottom_cyl": {
36      "radius_in_mm": 0,
37      "height_in_mm": 0,
38      "transition_in_mm": 0
39    },
```

## JSON Configuration Files

For every LEGEND detector

On GitHub: <https://github.com/legend-exp/legend-metadata/tree/master/hardware/detectors>

There also also documents where the different parameters of the geometry are explained: E.g. [https://github.com/legend-exp/legend-metadata/blob/master/hardware/detectors/detector-metadata\\_1.pdf](https://github.com/legend-exp/legend-metadata/blob/master/hardware/detectors/detector-metadata_1.pdf)

!!! Not all parameters are used by LegendGeSim.jl yet!  
Work in progress. ➡ Help is very welcome!

# LegendGeSim.jl Configuration Files

```
1 {
2   "environment":{
3     "crystal_t": 90.0,
4     "op_voltage": 4000,
5     "medium": "vacuum"
6   },
7   "simulation":{
8     "method": "SSD",
9     "cached_name": "vacuum_90K_4000V"
10  },
11  "setup":{
12    "preamp":{
13      "t_decay":50,
14      "t_rise":15,
15      "noise_sigma":3,
16      "max_e": 10000,
17      "offset": 2000
18    },
19    "fadc":{
20      "type": "generic",
21      "sampling_interval": 16
22    },
23    "trigger":{
24      "type": "trapezoidal",
25      "window_lengths": [250,250,250],
26      "threshold": 9
27    },
28    "daq": {
29      "type": "generic",
30      "nsamples": 3750,
31      "baseline_length": 1875
32    }
33  }
34 }
```

There are some parameters of the simulation which do not belong to a detector.

E.g.: Parameters of the PreAmps and DAQ

We also might want to play with certain parameters, like the bias voltage, in order to see the impact on the produced waveforms.

 LegendGeSim.jl-Configuration file

The main chain is done thanks to Mariia!

But there is a lot to be done.  
Contributions are very welcome!

GitRepo for this tutorial:

[https://github.com/lmh91/LegendGeSim\\_Tutorial](https://github.com/lmh91/LegendGeSim_Tutorial)