

# ND-GAr: Overlay tools.

ND Sim/Reco Physics group meeting

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ND-GAr group  
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# Software version used.

## To keep track

- GENIE is already at v3.. However, discussions in the past led to the agreement to keep using GENIE v2 (Oscillation analysis in the FD is done with v2)
- Software version for GENIE sample generation (flux files dk2nu/gsimple)

```
setup genie      v2_12_10c -q e15:prof
setup genie_xsec v2_12_10  -q DefaultPlusValenciaMEC
setup genie_phyopt v2_12_10 -q dkcharmtau
setup dk2nu      v01_05_01b -q e15:prof
setup ifdhq
```

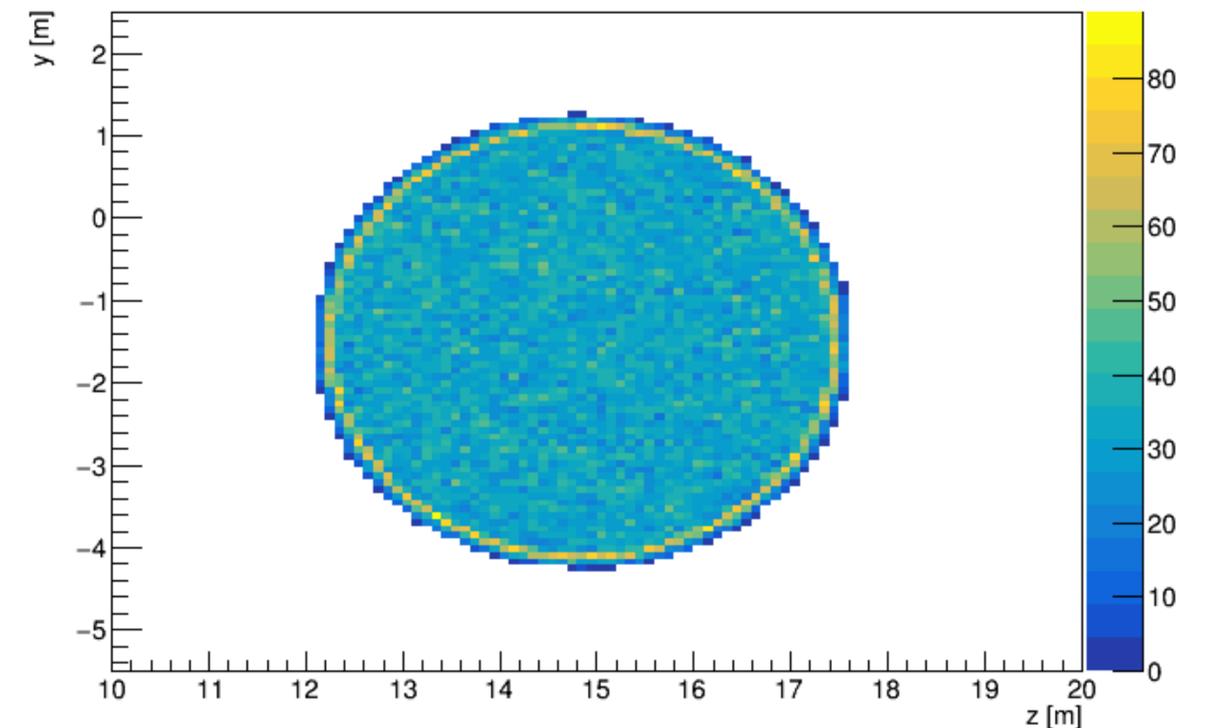
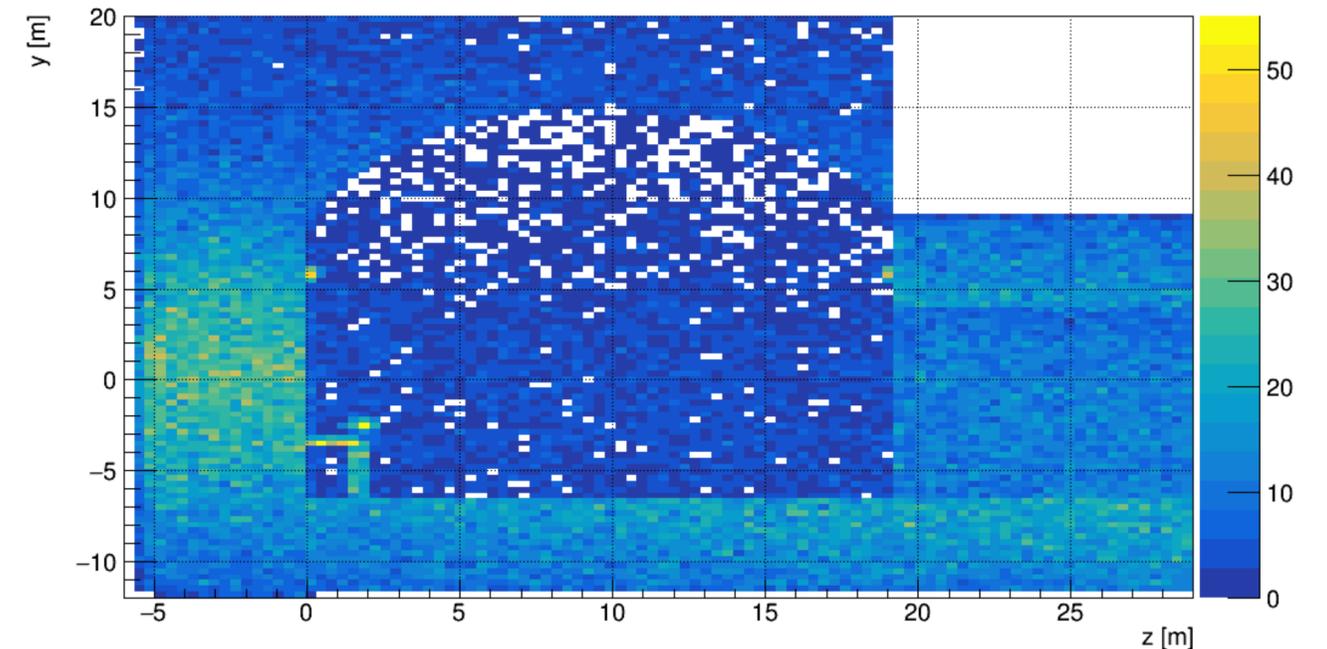
- Conversion from ghep to Roottracker file -> rock\_propagator tool on Github (gntpc\_dune)
- Overlay -> Overlay GENIE package (<https://github.com/GENIE-MC-Community/OverlayGenie>)
- Geant4 simulation
  - Using edep-sim (<https://github.com/ClarkMcGrew/edep-sim>), current release v3.0.0
  - Recent decision (yesterday) -> mirroring of edep-sim in the DUNE github repo to be able to easily patch (and propagate back to the base) and release as ups product (v3\_0\_1 as of yesterday)
- GArSoft (art based gen/digi/reco/ana for ND-GAr)
  - Not frozen yet, current version v02\_09\_00
  - Try to release regularly on cvmfs
  - Can do all the above to a certain degree (using GENIE v3 though)



# Rock generation.

## A critical step

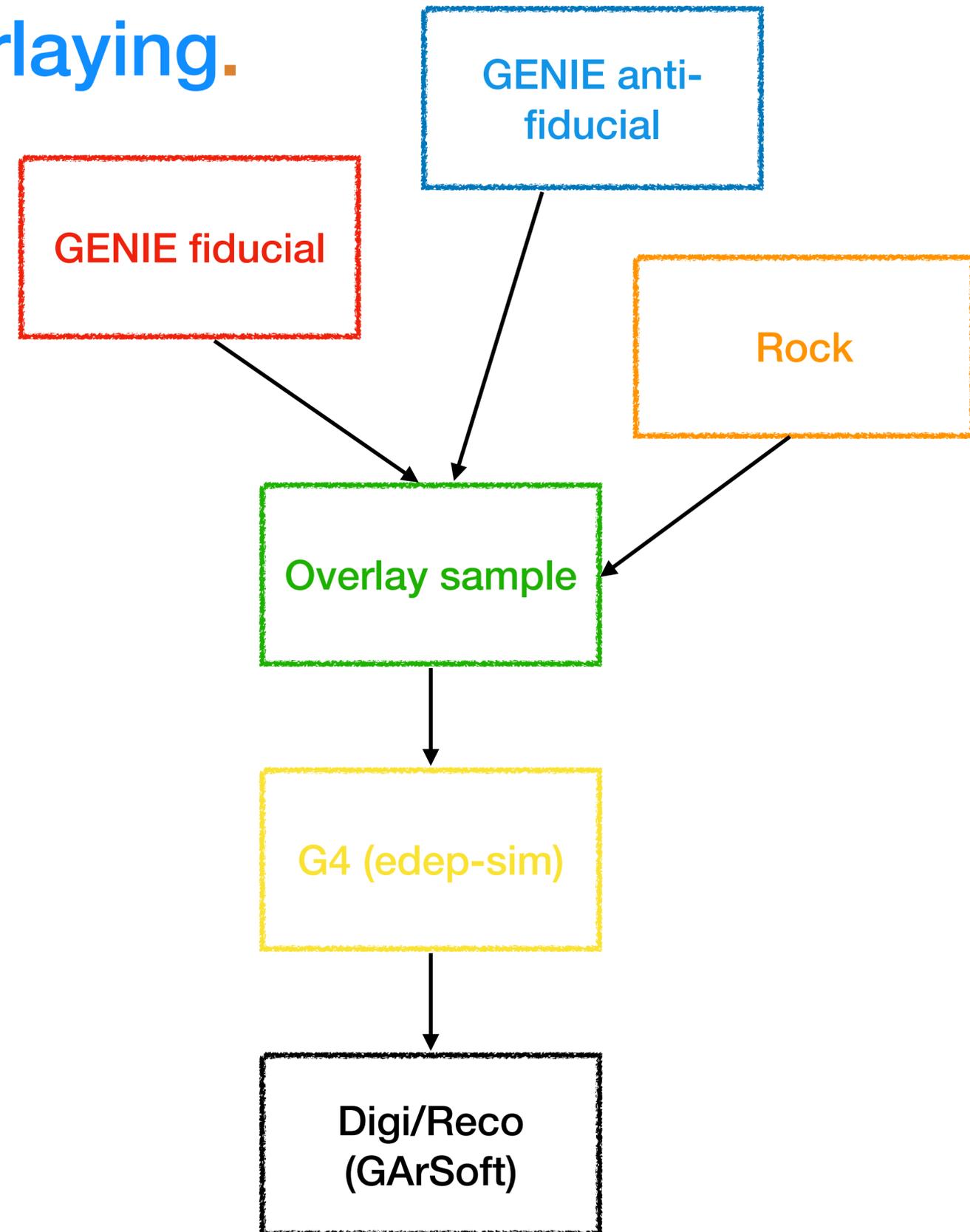
- Thanks to Tanaz for this.
- For backgrounds, a critical step is the rock sample.
- This step cannot be done during the usual background/signal sample generation
  - Rock volume enormous in from of the ND Hall
  - Would take too much time and most of GENIE events would be rock anyway...
  - -> Make this step separately
- Generate GENIE sample in the rock volume with the `gevgen_fnal` package
- Use the package `rock_propagation` ([https://github.com/DUNE/rock\\_propagation](https://github.com/DUNE/rock_propagation))
  - Propagates rock genie events in the geometry volume with `geant4` and put the events that make it to the detector hall boundary back into a `ghep` record
- This sample can then be used downstream with other samples before `edep-sim`



# Signal/Background generation and Overlaying.

## As currently done

- For signal/backgrounds sample generation, it is fast and simple
- We have “two” geometries: fiducial and anti-fiducial (active volume replaced with Air)
- We use the GENIE gevgen\_fnal package to generate both samples
- Then we overlay samples using the Overlay GENIE package
  - Can overlay any samples (signal/background/rock) with specific distributions and spill timing structure
  - Each end of spill is marked with a Rootino event -> see next slide
- The overlaid file is then converted into Roottracker file
- The Roottracker is used as input to edep-sim
- edep-sim can then be used by the groups with their own framework (may need to convert the edep-sim data format to their needs)



# Conversion to GST.

## A small issue

- Last March, I had an issue when converting overlay files from ghep to gst (GENIE summary tree) using the rock\_propagator package
- See PR: [https://github.com/DUNE/rock\\_propagation/pull/1](https://github.com/DUNE/rock_propagation/pull/1)
- Seems related to the Rootino event at the end of spill
  - The code is looking for a target -> Rootino does not interact...
  - Simple mitigation -> check if the target pointer is null -> skip the event in that case
- Small issue that may not matter much but should be fixed
  - Do we need to keep the information in the GST where the end of spill is?



**Backup Slides.**

