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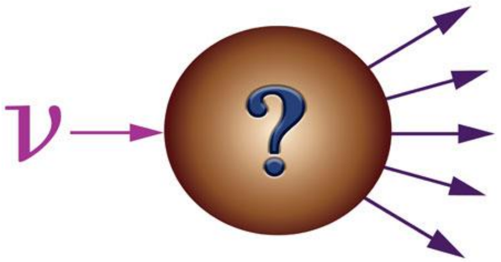
# LAr Software Ideas for Merging

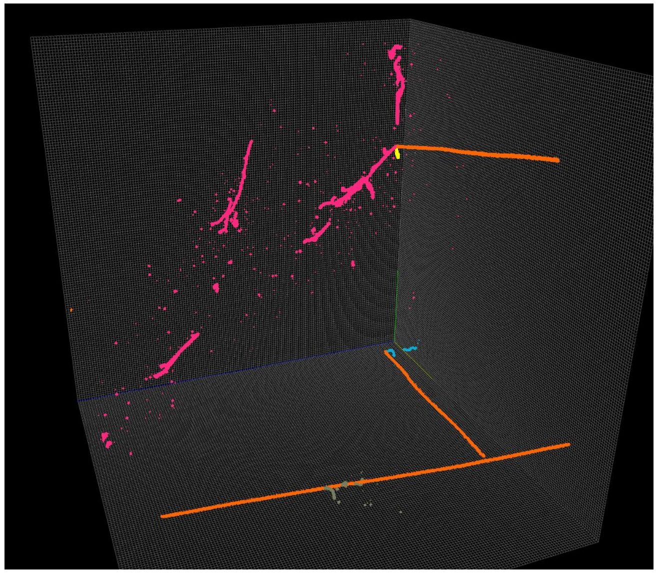
Kazu @ SLAC

# Simulation workflow

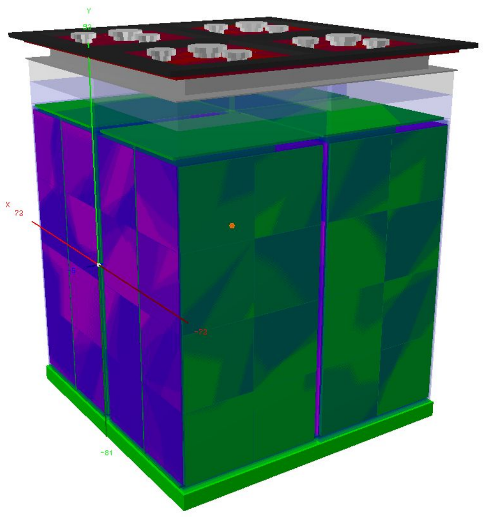
- Event generation
- Particle tracking
- Detector response



Neutrino-Nucleus interactions in the detector and surrounding materials



Tracking of generated and secondary particles in the detector and surrounding materials



Compute charge/light production, propagate to sensitive detector elements, produce readout output

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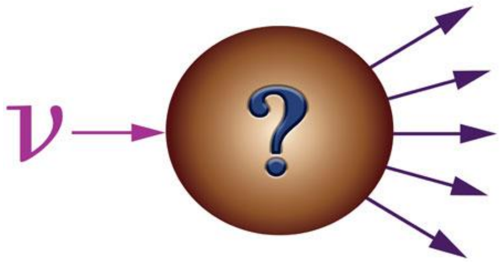

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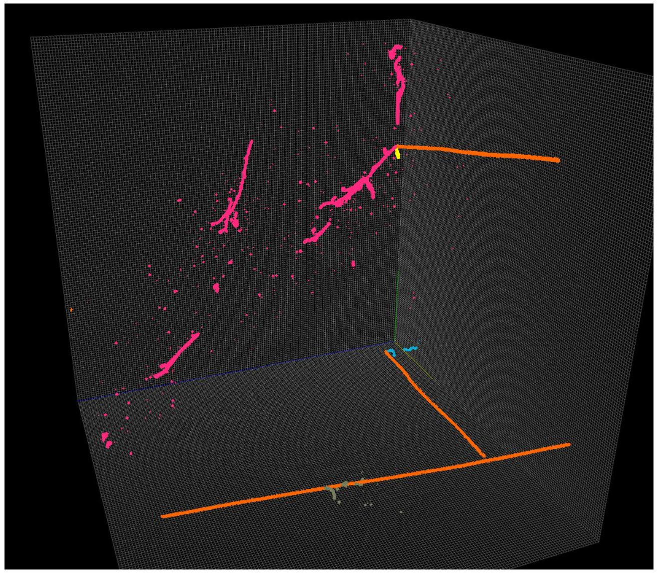
**Should be merged.** Particle tracking and energy deposition. Store particle type, dE and dX. **Need**: unified GDML, common Physics List, common version underlying software (ROOT, GeGeD-ND, Geant4). **Better**: common input & output data product library.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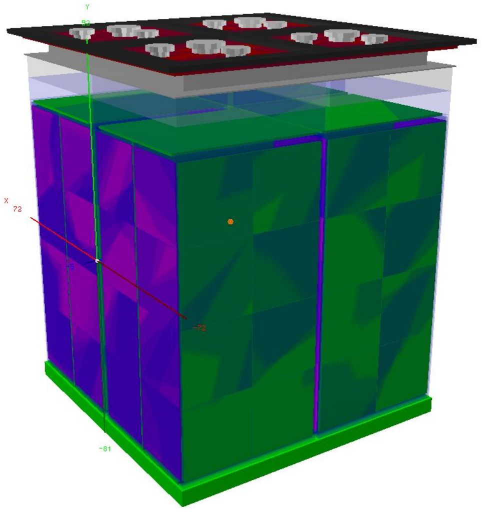

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  - **Major work**: a common Geant4 driver code
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  - **GArSoft**: it looks like an old LArSoft branch-off before modularization of libraries (i.e. not a brand-new development from art). It looks better to modularize libs instead of keep as a separate software. Challenge might be Geometry, but our recent development on generalizing readout element type might solve this issue.

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## Reconstruction … currently all outside LArSoft

- Probably no need to merge, but if useful, we should share
- Libraries (HPC-ready, either GPU or KNL, also runs on CPU)
  - MAGMA (+sparsehash-dev) for linear algebra, CUDA for GPU kernels, AVX-512 (optional) for KNL kernels, Open-MP for many-core multi-threading, MPI+Horovod for data broadcasting, pytorch/sci-kit/OpenCV for ML/computer-vision algorithms
- Eco-system
  - **Github** (Free and superior to redmine in many aspect if not all)
  - **Travis-CI** (Free)
  - **Docker/Singularity** hub with build auto-trigger (Free)