

LBNE Batch Job Payload Characteristics

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with much help from the Physics Tools Working Groups

- Far Detector Simulation
- 35t Simulation
- Beam Simulation
- FastMC

10 kt Far Detector Simulation Batch Payload

- Biggest issue: Memory usage. Simulating 10 kt with cosmic rays on the surface takes just under 4 GB of virtual memory. From T. Junk
307,200 readout wires + photon detectors (1200).
- Running multiple events per job increases memory usage (caching? leaking?)
- Output file size:
 - uncompressed, un-zero-suppressed, raw digits: ~2 GB
 - zero-suppressed, no noise, with cosmics: 300 MB/event
 - zero-suppressed, no noise, no cosmics, single particle or neutrino scatter: ~10 MB/event
- Required software:
 - LArSoft, which depends on
 - ART
 - GEANT4 + CLHEP
 - ROOT
 - lots of externals (Brett's list)
 - Don't explicitly need GENIE if generating CRY or particle gun or textfile input
- CPU usage: 1-2 hours per event with cosmics (unoptimized).
- A few minutes for the particle gun.

<https://cdcv.sfnal.gov/redmine/projects/larsoft/wiki>

<https://cdcv.sfnal.gov/redmine/projects/lbne-fd-sim/wiki>

10 kt Far Detector Batch Payload

Data Files to be transferred to batch workers for simulation jobs:

- GEANT4 data files
- GENIE (if running GENIE, which is optional)
- Photon Lookup Library (can be of order 300 MB, but optional)
- GDML for geometry (small, about 1-2 MB)

ROOT can be trimmed down in size – not all .so's are used, or documentation, or other components.

Can take some effort to pare down a root distribution to the bare minimum

Reconstruction Payloads

- Same as simulation for software requirements
- Similar memory requirements – geometry representation in memory plus data ~4 GB.
- Unoptimized choices for object storage in the event can push memory usage higher. LBNE specific modules keep this usage down.

35 t Phase 2 Simulation Batch Payload

- Much reduced virtual memory requirements – 2048 wires plus photon detectors (4?) plus triggers.
- Output file size:
 - uncompressed, un-zero-suppressed, raw digits: ~13 MB/event
 - zero-suppressed, no noise, no cosmics, 30 MeV electron: 50 kB/event
 - 100 MeV electron: 0.6 MB/event
- Required software:
 - LArSoft, which depends on
 - ART
 - GEANT4 + CLHEP
 - ROOT
 - lots of externals (Brett's list)
 - Don't explicitly need GENIE if generating CRY or particle gun or textfile input
- CPU usage: A few seconds/event for 30 MeV electrons.

Also have a 4-APA scaled-down FD version for computational ease.

10,240 wires + 40 photon detectors. Much faster and takes less memory!

Reconstruction payloads more realistic with 35t and 4APA geometries until we optimize memory usage.

<https://cdcv.sfnal.gov/redmine/projects/larsoft/wiki>

<https://cdcv.sfnal.gov/redmine/projects/lbne-fd-sim/wiki>

Beam Simulations Batch Job Characteristics

From L. Fields

- Memory per job slot: ~200 MB
- CPU – for a test, arbitrarily small or large, just simulate more or fewer beam particles
- Output file size – the test job makes a 2 MB output file and takes ~10 minutes of CPU
- Required Software:
 - G4LBNE V3 (not a large package itself), which needs
 - GEANT4 + CLHEP
 - ROOT
 - The Fermilab setup scripts sets these up with UPS, but it's not necessary, you can use your own versions (though you may not get the same results. The setup script sets up GEANT 4.9.4p03, and ROOT 5.30.06

<https://cdcv.s.fnal.gov/redmine/projects/lbne-beamsim/wiki>

FastMC Batch Job Characteristics

From D. Cherdack

- Virtual memory size: not explicitly benchmarked (several classes of jobs), but they all run on Fermigrid so < 2 GB.
- CPU – arbitrary. Long or short test jobs possible
- I/O: small writes, but need to read GENIE splines and other input files.

External software requirements:

Currently packed up in:

/lbne/app/users/lblpwg_tools/SOFTWARE

(does not depend on installed software in ups)

23 GB total in that directory (lots of documentation, examples, source code, datafiles)

- GENIE
- GLoBES
- ROOT
- PYTHIA
- LHAPDF
- GSL
- log4cpp

https://cdcvs.fnal.gov/redmine/projects/fast_mc/wiki/Fast_MC_Basics

MARS Batch Job Characteristics

Virtual Memory high-water mark: 500 MB for MARS+ROOT
Add in EGS, can go over 2 GB

From D. Reitzner

Required software: (/grid/fermiapp/marslbne/mars)

MARS 744 MB

ROOT 656 MB (but can be trimmed down. Probably don't need documentation or tutorials)

MCNP4C 841 MB

EGS5 140 MB

Input files: Can be very small, or several GB, depending on source term

Output files: Can be a few MB or several GB