

# Resource usage of jobs for MicroBooNE Monte Carlo Challenge 5

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MicroBooNE and LArSoft meeting for MCC5, August 5<sup>th</sup>, 2014

# Configuration files

I have been presented on Monday with the following list:

**generation** `prod_muminus_0.1-2.0GeV_isotropic_uboone.fcl & co., prodcosmics.fcl, prodgenie_<bnb|numi>_<nu|nue>[_dirt][_cosmics].fcl`

**GEANT** `standard_g4_uboone.fcl`

**digitization** `standard_detsim_uboone.fcl`

**reco (2D)** `standard_reco_uboone_2D.fcl`

**reco (3D)** `standard_reco_uboone_3D.fcl`

**analysis** `standard_ana_uboone.fcl`

All are expected to be in `develop` branch of `uboonecode` by now. I do expect minor changes before the challenge takes place.

# Event generation

Tested:

- all combinations of GENIE events (NuMI/BNB,  $\nu/\nu_e$ , dirt, cosmic rays)
- cosmic rays only
- $\mu^-$  with 0.1 – 2.0 GeV/ $c$

Some figures on 100-event tests (10 for heap profile):

process	time [s/evt]	heap [MB]
cosmics	0.065	not tested
$\mu^-$	< 0.001	not tested
$\nu$ (BNB) + cosmics	0.17	500 (spikes: 150)
$\nu$ (BNB) in dirt + cosmics	0.36	500 (spikes: 150)

- `RandomNumberSaver` should be run as the first module, not last
- spikes present ( 150 MB)

# Detector simulation (GEANT)

Test on top of the previous 100-event  $\nu_e$  (BNB) + cosmics sample.

phase	time [s/evt]	heap [MB]
GEANT + optical	45	1100 (spikes: 250)

Includes modifications, all currently in `develop`:

- by William to simplify processing of neutral resonances
- (by Kazuhiro?) to use the PMT quantum efficiency earlier (no unseen photon are generated)
- by Kazuhiro and Gianluca to `sim::SimChannel`
- by Tia and Gianluca to `sim::AuxDetSimChannel`

Notes:

- `RandomNumberSaver` should be run as the first module, not last
- spikes present ( 150 MB)

# Detector simulation (GEANT): analysis

## Memory profile:

source	heap [MB]	comments
RootOutput	300–450	spikes ( <code>simb::MCParticle?</code> )
Photon library	310	(maybe a bit more)
<code>simb::MCParticle</code>	150	temporary, for storage

## CPU usage profile (single event: 45 s):

source	fraction	comments
RootOutput	25%	
LArG4	75%	many users

## Notes:

- `RandomNumberSaver` should be run as the first module, not last
- spikes present ( 150 MB)
- speed might be improved with the help of GEANT experts

Work on revisiting `simb::MCParticle` is at an early stage (thanks Brian!) and not guaranteed to succeed.

# Detector simulation (digitization)

Test on top of the previous 100-event  $\nu_e$  (BNB) + cosmics sample.

configuration	time [s/evt]	peak [GB]
<code>standard_detsim_uboone.fcl</code>	76.2	1.65
... + Huffman compression	42.2	1.15

Includes modifications, all currently in `develop`:

- by Yun-Tse, Leon et al. on field response

Notes:

- `RandomNumberSaver` should be run as the first module, not last

# Detector simulation (digitization): analysis

Memory profile (compressed version only):

source	heap [MB]	comments
Total usage	1300	plus spikes (150 MB)
RootOutput	900	spikes ( <code>simb::MCParticle?</code> )
ROOT input	150	
<code>optdet::UBADCBASE</code>	50	optical detector
<code>SimWireMicroBooNE</code>	40	TPC wires

CPU usage profile (single event: 45 s):

source	fraction	comments
RootOutput	44%	
Convolute	22%	
GenNoiseInTime	16%	
GenWaveform	4%	optical detector

I haven't started the evaluation of the new FCL file yet.

Known issues to be investigated:

- memory leak in `flameCluster` (Ben Carls on it)
- crash in `RFFHitFinder`, keeping me busy since weeks, may be related to raw digit compression, regions of interest, both or neither



I haven't started the evaluation yet.

# Summary so far

- event generation present no problem (as expected)
  - GEANT simulation can fit in 3 GB slots, 2 GB slots are tight
  - detector simulation shows no issue
  - need reco test before recommending the use of Huffman compression
  - I haven't started the evaluation of reconstruction and analysis steps
- ⇒ likely, there will be a lot of work in there
- `RandomNumberSaver` should be moved to the very beginning of the producers chain